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SOIL SURVEY
Sullivan County, Indiana

Major fieldwork for this soil survey was done in the period 1958–62. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the Purdue University Agricultural Experiment Station. It is part of the technical assistance furnished to the Sullivan County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have

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SOIL SURVEY OF SULLIVAN COUNTY, INDIANA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE PURDUE UNIVERSITY AGRICULTURAL EXPERIMENT STATION

SULLIVAN COUNTY, in the southwestern part of Indiana (fig. 1), has an area of 292,480 acres, or 457 square miles. In 1960, the population of the county was 21,721. Sullivan, the county seat, is near the center of the county.

Busseron Creek is the largest stream.

Sullivan County is used mainly for farming. Corn and soybeans are the main crops. Livestock is raised both for

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Alford silt loam, 2 to 6 percent slopes, eroded, is one of several phases within the Alford series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Gullied land is a land type in Sullivan County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are esti-

who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The six soil associations in Sullivan County are described in the following pages.

1. Cincinnati-Ava-Alford association

Deep, well drained and moderately well drained, nearly level to very steep soils that have a loam to silty clay loam subsoil; on uplands

This association occurs on uplands throughout the county and takes in about 33 percent of the land area. About 27 percent of the acreage consists of Cincinnati soils, about 23 percent of Ava soils, about 15 percent of Alford soils, and the rest of less extensive soils.

Cincinnati soils are well drained and gently sloping to strongly sloping. They have a surface layer of dark grayish-brown and yellowish-brown silt loam and a subsoil that is mostly dark yellowish-brown and yellowish-brown silty clay loam. Ava soils are moderately well drained and nearly level to gently sloping. They have a surface layer of dark grayish-brown and brown silt loam and a subsoil of yellowish-brown and light yellowish-brown heavy silt loam and light silty clay loam. Both the Cincinnati and Ava soils have, at a depth of 22 to 34 inches

About 54 percent of the acreage consists of Reesville soils, about 32 percent of Iva soils, and the rest of less extensive soils.

Reesville soils are somewhat poorly drained and nearly level to gently sloping. They have a surface layer of dark

4. Wakeland-Stendal-Genesee association

Deep, well-drained to somewhat poorly drained, nearly level soils that have a loam or silt loam subsoil; on bottom lands

hay are the main crops. Vegetable crops, such as potatoes, tomatoes, and green beans, are grown under irrigation.

A medium or low available moisture capacity is the main limitation of the Warsaw, Elston, and Fox soils. In years when rainfall is less than average or is poorly distributed, crops on these soils are subject to damage from drought. Rensselaer and Westland soils have a limitation of wetness.

6. *Lyles-Henshaw-Patton association*

Deep, somewhat poorly drained to very poorly drained, nearly level and gently sloping soils that have a sandy loam to silty clay loam subsoil; on terraces and uplands

This association occurs on terraces and uplands in the south-central and western parts of the county. It takes in about 7 percent of the land area. About 27 percent of the

on the detailed soil map. At the end of the description of each mapping unit are listed the capability unit and the woodland group in which the mapping unit has been placed. The page where each of the capability groups is described and the table describing woodland groups can be found readily by referring to the "Guide to Mapping Units."

For more general information about the soils, the reader can refer to the section "General Soil Map," in which the broad patterns of soils are described. The soil map at the back of this publication shows the location and distribution of the mapping units, and the "Guide to Mapping Units" gives the page on which each is described. The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many terms used in describing the soil series and mapping units

TABLE 1.—*Approximate acreage and proportionate extent of soils*

Soil	Acres	Percent	Soil	Acres	Percent
Ade loamy fine sand, 2 to 6 percent slopes	1, 360	0. 5	Iona silt loam, 0 to 2 percent slopes	833	. 3
Ade loamy fine sand, 6 to 12 percent slopes	1, 605	. 5	Iona silt loam, 2 to 6 percent slopes, eroded	9, 019	3. 4
Alford silt loam, 2 to 6 percent slopes, eroded	4, 315	1. 5	Iona silt loam, 2 to 6 percent slopes, severely eroded	1, 800	. 6
Alford silt loam, 2 to 6 percent slopes, severely eroded	995	. 3	Iva silt loam, 0 to 2 percent slopes	18, 634	6. 4
Alford silt loam, 6 to 12 percent slopes, eroded	2, 607	. 9	Iva silt loam, 2 to 4 percent slopes, eroded	4, 082	1. 4
Alford silt loam, 6 to 12 percent slopes, severely eroded	4, 062	1. 4	Kings silty clay	490	. 2
Alford silt loam, 12 to 18 percent slopes, eroded	946	. 3	Lyles loam	4, 356	1. 5
Alford silt loam, 12 to 18 percent slopes, severely eroded	1, 063	. 4	Markland silt loam, 2 to 6 percent slopes, eroded	495	. 2
Alford silt loam, 18 to 25 percent slopes	850	. 3	Markland silt loam, 12 to 18 percent slopes, eroded	422	. 1
Alford silt loam, 25 to 50 percent slopes	335	. 1	Markland silt loam, 18 to 25 percent slopes, eroded	476	. 2
Atkins silt loam	530	. 2	Markland silty clay loam, 6 to 18 percent slopes, severely eroded	533	. 2
Ava silt loam, 0 to 2 percent slopes	2, 160	. 7	McGary silt loam	301	. 1
Ava silt loam, 2 to 6 percent slopes, eroded	15, 748	5. 4	Mine dumps	318	. 1
Ava silt loam, 2 to 6 percent slopes, severely eroded	5, 175	2. 0	Muren silt loam, 2 to 6 percent slopes, eroded	710	. 2
Ayrshire fine sandy loam, 0 to 2 percent slopes	7, 271	2. 5	Parke silt loam, 6 to 12 percent slopes, severely eroded	191	. 1
Ayrshire fine sandy loam, 2 to 4 percent slopes	1, 132	. 4	Parke silt loam, 12 to 18 percent slopes, severely eroded	288	. 1
Ayrshire loam, 0 to 2 percent slopes	855	. 3	Patton silty clay loam	2, 141	. 7
Bloomfield loamy fine sand, 2 to 6 percent slopes	3, 744	1. 3	Petrolia silty clay loam	958	. 3
Bloomfield loamy fine sand, 6 to 12 percent slopes	3, 594	1. 2	Princeton fine sandy loam, 0 to 2 percent slopes	3, 309	1. 1
Bloomfield loamy fine sand, 12 to 18 percent slopes	2, 915	1. 0	Princeton fine sandy loam, 2 to 6 percent slopes, eroded	6, 137	2. 1
Bloomfield loamy fine sand, 18 to 40 percent slopes	1, 293	. 4	Princeton fine sandy loam, 6 to 12 percent slopes, eroded	1, 251	. 4
Carlisle muck	185	. 1			
Cincinnati silt loam, 2 to 6 percent slopes					

available moisture capacity is a limitation. In years when

coatings on a few ped faces and in crack fills; strongly

and the available moisture capacity is high. The organic-matter content is low. The surface layer is strongly acid

lowish-brown, firm silty clay loam, and the lower part is pale-brown to yellowish-brown, friable silt loam. The

Corn, soybeans, small grain, hay, and pasture are suitable crops. Alfalfa is less suitable because it is damaged by wetness, frost heave, and the restriction of root development. Crops respond well to lime and fertilizer. The slowly permeable fragipan is a limitation. Perching of water above the fragipan often results in some delay in spring farming operations. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIw–5; woodland group 9)

Ava silt loam, 2 to 6 percent slopes, eroded (AIB2).—This soil is on side slopes and ridgetops and at the head of drainageways. From 3 to 6 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the yellowish-brown subsoil. Included in mapping were small areas of slightly eroded soils and a few small areas of seepy soils.

Corn, soybeans, small grain, hay, and pasture are suit-

lying material is strong-brown and gray, friable, stratified silt and fine sand.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Nearly level and gently sloping soils of this series occur on the uplands in the western and southern parts of this county.

Typical profile of Ayrshire fine sandy loam in a cultivated field, at a point 270 feet west and 240 feet north of the southeast corner of the SW¼ sec. 17, T. 9 N., R. 10 W.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

A2—8 to 12 inches, light brownish-gray (10YR 6/2) fine sandy loam; weak, medium, platy structure; friable when moist; slightly acid; clear, smooth boundary.

B1—12 to 18 inches, light brownish-gray (10YR 6/2) loam;

Ayrshire loam, 0 to 2 percent slopes (AyA).—This soil occurs as small areas on broad flats.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained. Vegetable crops can be grown under irrigation. Water for irrigation can be obtained in the vicinity of Rogers Ditch and Highway 58, where water-bearing sand and gravel occur below a depth of 50 inches. Crops respond well to lime and fertilizer. Wetness is the major

slopes. Included in mapping were a few small areas of nearly level sandy soils.

Orchard fruits, melons, corn, soybeans, small grain, alfalfa, and hay are suitable crops. The low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Erosion is a hazard. (Capability unit IIIs–1; woodland group 15)

Bloomfield loamy fine sand, 6 to 12 percent slopes

1—0 to 10 inches, black (10YR 2/1) muck; weak, medium, granular structure; friable when moist; many, small, yellowish-red (5YR 4/8) fragments of wood and peat; slightly acid; gradual, wavy boundary.

2—10 to 22 inches, very dark brown (10YR 2/2) muck; moderate, medium, granular structure; friable when moist; many, small, yellowish-red (5YR 4/8) and dark-brown (7.5YR 3/2) fragments of peat and wood; slightly acid;

blocky structure; firm when moist; strongly acid; clear, smooth boundary.

B22t—22 to 29 inches, dark yellowish-brown (10YR 4/4) silty clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist; thin, brown (10YR 5/3) clay films on ped faces; strongly acid; clear, smooth boundary.

IIBx—29 to 51 inches, dark yellowish-brown (10YR 4/4) gritty

of erosion is very high. Crops respond well to lime and fertilizer. The available moisture capacity is medium.

at a point 440 feet south and 50 feet west of the northeast corner of the SE¼NW¼ sec. 6, T. 9 N., R. 8 W.

[redacted]

B3—37 to 58 inches, dark yellowish-brown (10YR 4/4) sandy loam; weak, coarse, subangular blocky structure; friable when moist; scattered small pebbles; strongly acid; clear, smooth boundary.

IIC—58 to 64 inches +, brown (10YR 5/3) stratified sand; interbedded with thin layers of gravelly sand and fine gravel; loose; slightly acid.

The Ap horizon ranges from black to very dark grayish brown in color and from 12 to 16 inches in thickness. The colors of the B horizon include brown, dark brown, and dark yellowish brown. The texture of the B21t and B22t horizons is loam, light sandy clay loam, or light clay loam. The depth to the IIC horizon ranges from 36 to 60 inches. This horizon is medium acid to slightly acid in the upper part and becomes mildly alkaline with depth.

Elston fine sandy loam, 0 to 2 percent slopes (EtA).—This soil is on broad terraces along the Wabash River. Included in mapping were small areas of gently sloping, sandy soils.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Surface runoff is very slow. The medium available moisture capacity and slight droughtiness are limitations. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIs–2; woodland group 23)

Elston fine sandy loam, 2 to 6 percent slopes (EtB).—This soil is on short breaks on broad terraces along the Wabash River. Included in mapping were small areas of moderately eroded sandy soils. Also included were a few areas of moderately sloping sandy soils.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Erosion resulting from slow surface runoff is a hazard. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIe–13; woodland group 23)

Elston loam, 0 to 2 percent slopes (EuA).—This soil is on broad terraces along the Wabash River. It is the most extensive of the Elston soils. Included in mapping were a few small areas of soils that have a surface layer of silt loam.

Corn, soybeans, grain sorghum, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Surface runoff is slow. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIs–2; woodland group 23)

Elston loam, 2 to 6 percent slopes (EuB).—This soil is on breaks below nearly level terraces along the Wabash River. Included in mapping were small areas of moderately eroded sandy soils.

Corn, soybeans, grain sorghum, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Crops respond well to fertilizer. Erosion is a hazard. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. Because of the short and irregular slopes, erosion control practices are limited to minimum tillage, contour farming, and the use of winter cover crops. (Capability unit IIe–8; woodland group 23)

Fox Series

The Fox series consists of deep, well-drained soils that have a medium-textured to moderately coarse textured surface layer and a moderately fine textured subsoil. These soils are on terraces. They formed in 24 to 42 inches of outwash over gravel and sand. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of brown loam. The subsoil is about 33 inches thick. The upper 11 inches is brown to reddish-brown, firm clay loam. The lower part is reddish-brown, firm gravelly clay loam. The underlying material is brown, stratified, loose gravel and sand.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is medium to low. The organic-matter content is low.

Nearly level to gently sloping soils of this series occur on gravelly terraces in the southwestern part of this county.

Typical profile of Fox loam in a cultivated field (now a gravel pit), at a point 150 feet north and 125 feet east of the southwest corner of the NE¼ sec. 7, T. 9 N., R. 10 W.

Ap—0 to 8 inches, brown (10YR 5/3) loam; weak, fine, granular structure; friable when moist; slightly acid; abrupt, smooth boundary.

B1t—8 to 12 inches, brown (7.5YR 4/4) light clay loam; moderate, medium, angular and subangular blocky structure; firm when moist; medium acid; clear, smooth boundary.

B21t—12 to 19 inches, reddish-brown (5YR 4/4) clay loam; some gravel in lower part; moderate, medium and coarse, angular and subangular blocky structure; firm when moist; thin, dark-brown (7.5YR 3/2) and dark reddish-brown (5YR 3/4) clay films on ped faces; medium acid; clear, wavy boundary.

B22t—19 to 41 inches, reddish-brown (5YR 4/3) gravelly clay loam; moderate, medium and coarse, subangular blocky structure; firm when moist; thin, dark-brown (7.5YR 3/2) clay films on ped faces; medium acid; abrupt, irregular boundary; tongues 6 to 12 inches thick extend into the underlying material.

IIC—41 to 60 inches +, brown (10YR 5/3) stratified gravel and sand; loose; calcareous.

The Ap horizon ranges from dark grayish brown to brown in color and from loam to sandy loam in texture. In some places where the Ap horizon is sandy loam, the B2 horizon is sandy clay loam. The tongues of B2 material that extend into the IIC horizon vary in thickness and number. The depth to the IIC horizon ranges from 24 to 42 inches.

Fox sandy loam, 0 to 2 percent slopes (FsA).—This soil is on broad terraces along the Wabash River.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Permeability is moderate, and surface runoff is slow. The low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to very severe damage from drought. (Capability unit IIIs–2; woodland group 2)

Fox sandy loam, 2 to 6 percent slopes (FsB).—This soil is on breaks on broad terraces along the Wabash River.

Included in mapping were small areas of gently sloping and moderately sloping soils that are moderately eroded.

Grain sorghum, corn, soybeans, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Erosion is a hazard, and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. (Capability unit IIIe–13; woodland group 2)

Fox loam, 0 to 2 percent slopes (FxA).—This soil is on broad terraces east of the Wabash River. Included in mapping were a few small tracts that have a surface layer of silt loam.

Corn, soybeans, grain sorghum, small grain, hay, and pasture are suitable crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation. Permeability is moderate, and surface runoff is slow. The medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIs–1; woodland group 1)

Genesee Series

The Genesee series consists of deep, well-drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has a 9-inch surface layer of dark grayish-brown silt loam. The subsoil is about 21 inches

cluded were a few small areas of soils that have a surface layer of loam.

All the crops commonly grown in the county are suitable, but alfalfa and small grain are likely to be severely damaged by prolonged floods. Flooding between the months of December and June is the major hazard. (Capability unit I–2; woodland group 8)

Genesee Series, Sandy Variant

The Genesee series, sandy variant, consists of deep, well-drained soils that have a moderately coarse textured surface layer and a medium-textured to moderately coarse textured subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of dark grayish-brown fine sandy loam. The upper 4 inches of the subsoil is brown, very friable fine sandy loam, and the lower 4 inches is dark-brown, friable loam. The underlying material is yellowish-brown, very friable fine sandy loam over stratified loam, fine sandy loam, and loamy fine sand.

Permeability is moderately rapid, surface runoff is slow, and the available moisture capacity is medium. The organic-matter content is low. The surface layer is slightly acid to mildly alkaline.

Nearly level soils of this series occur on bottom lands near old channels and oxbows of the Wabash River.

Typical profile of Genesee fine sandy loam, sandy variant, in a cultivated field, at a point 450 feet south and

Figure 3.—Levee (background) on Genesee silt loam. Pumping plant and structure at right discharge surface water through the levee into the Wabash River.

distributed, crops are subject to damage from drought. (Capability unit I–2; woodland group 8)

Gullied Land

Gullied land (Gu) (fig. 4) occurs on uplands t[illegible]

on terraces. They formed in lakebed deposits. The native vegetation was mixed hardwood forest.

A typical profile has a 12-inch surface layer of silt loam, dark grayish brown in the upper 8 inches and pale brown in the lower part. The subsoil is about 30

lands. They formed in a deposit of no more than 20 inches of loess and the underlying material weathered from till. The native vegetation was mixed hardwood forest.

A typical profile has a 7-inch surface layer of silt loam. The upper 2 inches is very dark gray, and the lower part is pale brown. The subsoil is about 43 inches thick. The uppermost 4 inches is light yellowish-brown, friable silt loam. Below this is 8 inches of yellowish-brown, firm silty clay loam, over 22 inches of strong-brown, firm clay loam. The lowermost 9 inches of the subsoil is yellowish-brown, firm clay loam. The underlying material is grayish-brown, friable loam.

Permeability is moderate, surface runoff is rapid, and the available moisture capacity is high. The organic-matter content is low.

Moderately steep to very steep soils of this series occur on the uplands in the eastern and northern parts of this county.

Typical profile of Hickory silt loam in a wooded area, at a point 450 feet south and 400 feet west of the northeast corner of sec. 23, T. 8 N., R. 8 W.

O2—½ inch to 0, partly decomposed leaf litter; very strongly acid.

A1—0 to 2 inches, very dark gray (10YR 3/1) silt loam; moderate, fine, granular structure; friable when moist; very strongly acid; abrupt, wavy boundary.

A2—2 to 7 inches, pale-brown (10YR 6/3) silt loam; moderate, thick, platy structure; friable when moist; abundant [illegible] A1 material; very strong

Hickory silt loam, 18 to 35 percent slopes, severely eroded (HkF3).—This soil is on the side slopes of drainageways and in areas below ridgetops. From 5 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is mostly original subsoil. There are a few gullies in some areas. Included in mapping were small areas of moderately eroded soils. Also included were small areas of soils that have a reddish-brown, rapidly permeable subsoil and underlying material. Small tracts of very steep soils occur in some areas.

This soil is suitable for use as woodland. Runoff and erosion are the major hazards. (Capability unit VIe–1; woodland group 2)

Hickory silt loam, 35 to 50 percent slopes (HkG).—This soil is on escarpments and on the side slopes of deep valleys. Included in mapping were small areas of moderately eroded soils.

This soil is suitable for use as woodland. Runoff and erosion are the major hazards. A permanent cover of vegetation helps to control runoff and erosion. (Capability unit VIIe–1; woodland group 4)

Iona Series

The Iona series consists of deep, moderately well drained soils that have a medium-textured surface layer and a moderately fine textured to medium textured subsoil. These soils are on uplands. They formed in silty

along vertical cracks; few very dark brown (10YR 2/2) concretions of iron and manganese; strongly acid, grading to slightly acid to neutral in lower part; clear, wavy boundary.

B3—34 to 50 inches, light yellowish-brown (10YR 6/4) to brownish-yellow (10YR 6/6) silt loam; weak, coarse, subangular blocky structure; friable when moist; thin gray-

Permeability is slow, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Nearly level to gently sloping soils of this series occur on the uplands in the eastern half of this county.

Kings Series

The Kings series consists of deep, very poorly drained soils that have a fine-textured surface layer and subsoil. These soils are in depressions on lake terraces. They formed in fine-textured, water-deposited sediments. The native vegetation consisted of swamp forest and marsh grass.

A typical profile has a 16-inch surface layer of black silty clay. The lower 10 inches is mottled. The subsoil is about 32 inches thick. The upper 21 inches is dark-gray,

Lyles Series

The Lyles series consists of deep, very poorly drained soils that have a medium-textured surface layer and a moderately fine textured to moderately coarse textured subsoil. These soils are in depressions on uplands and terraces. The native vegetation was swamp forest.

A typical profile has a 16-inch surface layer of loam, very dark gray in the upper 8 inches and very dark gray to very dark grayish brown in the lower part. The subsoil is about 22 inches thick. The upper 12 inches is dark-gray,

Markland Series

The Markland series consists of deep, well drained and moderately well drained soils that have a medium-textured surface layer and a moderately fine textured to fine textured subsoil. These soils are on terraces. They formed in lacustrine material. The native vegetation was mixed hardwood forest.

A typical profile has a 7-inch surface layer of dark grayish-brown silt loam. The subsoil is about 19 inches thick. The uppermost 3 inches is brown to yellowish-brown, firm light silty clay loam. The middle 4 inches is yellowish-brown, very firm silty clay. The rest is dark yellowish-brown, very firm silty clay. The underlying material is brown, mottled, very firm clay or silty clay.

Permeability is slow, surface runoff is medium to very rapid, and the available moisture capacity is high. The organic-matter content is low. The surface layer is slightly acid or neutral.

Gently sloping to moderately steep soils of this series

Markland silt loam, 12 to 18 percent slopes, eroded (MaD2).—This soil is on side slopes of natural draws below ridgetops. From 2 to 4 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of slightly eroded soils.

Hay and pasture are suitable crops. Erosion resulting from rapid surface runoff is the major hazard. (Capability unit VIe–1; woodland group 18)

Markland silt loam, 18 to 25 percent slopes, eroded (MaE2).—This soil is along natural draws and on breaks along large streams. It has short slopes. From 2 to 4 inches of its original surface layer has been lost through erosion. Included in mapping were small areas of slightly eroded, steep soils and small areas of severely eroded soils.

This soil is suited to permanent pasture. Erosion resulting from very rapid surface runoff is the major hazard. (Capability unit VIe–1; woodland group 18)

Markland silty clay loam, 6 to 18 percent slopes

IIB21t—11 to 17 inches, grayish-brown (10YR 5/2) heavy silty clay loam; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular and angular blocky structure; firm when moist; slightly acid; clear, smooth boundary.

IIB22t—17 to 33 inches, grayish-brown (10YR 5/2) silty clay; common, medium, distinct, yellowish-brown (10YR 5/4) mottles; weak, medium, prismatic structure breaking to strong, medium and coarse, angular blocky; very firm when moist; few, small, very dark gray (10YR 3/1) concretions of iron and manganese; thin gray (10YR 5/1) clay films on ped faces; medium acid; clear, smooth boundary.

IIB23t—33 to 40 inches, grayish-brown (10YR 5/2) silty clay; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, coarse, angular blocky structure; very firm when moist; thin gray (10YR 5/1) clay films on ped faces; slightly acid; clear, irregular boundary.

IIC—40 to 50 inches +, brown (10YR 5/3) silty clay; common, medium, distinct, light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; moderate, very coarse, angular blocky structure; very firm when moist; few small concretions of lime; calcareous.

The Ap horizon ranges from gray to dark gray to dark grayish brown in color. In some places all of the A2 horizon has been incorporated into the Ap horizon. The depth to the IIC horizon ranges from 35 to 50 inches. The IIC horizon is mainly silty clay or clay, but in some places it is heavy silty clay loam or heavy silty clay loam stratified with clay. The number of lime concretions in this horizon ranges from none to many.

McGary silt loam (Mg).—This soil is on terraces. The slope range is 0 to 2 percent. Included in mapping were small areas of gently sloping, moderately eroded soils next to drainageways.

Corn, soybeans, small grain, hay, and pasture can be grown if a drainage system is established and maintained. Crops respond well to fertilizer. Wetness and a very slowly permeable subsoil are the major limitations, and maintenance of the organic-matter content is a problem. (Capability unit IIIw–6; woodland group 5)

Mine Dumps

Mine dumps (Mn) consists of mixtures of carbonaceous shale and low-grade coal piled near shaft mines and at loading points where coal is cleaned and sorted.

Most of this material is too acid to support plant growth, but areas where the material is sufficiently leached are suitable for development as wildlife habitat. (Capability unit VIIIs–1; woodland group 16)

Muren Series

The Muren series consists of deep, moderately well drained soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on uplands. They formed in silty loess. The native vegetation was mixed hardwood forest.

Permeability is moderate, surface runoff is medium, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Gently sloping soils of this series occur on the uplands in the central and southeastern parts of this county.

Typical profile of Muren silt loam in a cultivated field, at a point 400 feet north and 10 feet east of the southwest corner of the NW¼ sec. 33, T. 6 N., R. 8 W.

Ap—0 to 7 inches, dark yellowish-brown (10YR 4/4) silt loam; weak, medium, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

A2—7 to 11 inches, yellowish-brown (10YR 5/4) silt loam; moderate, medium, platy structure; friable when moist; medium acid; clear, smooth boundary.

B1t—11 to 20 inches, dark yellowish-brown (10YR 4/4) light silty clay loam; few, fine, faint, yellowish-brown (10YR 5/6) and common, fine, distinct, light brownish-gray (10YR 6/2) mottles; moderate, fine to medium, subangular blocky structure; firm when moist; few dark-brown (10YR 3/3) stains and clay films on ped faces; medium acid; clear, smooth boundary.

B21t—20 to 34 inches, light yellowish-brown (10YR 6/4) silty clay loam; common, medium, light brownish-gray (10YR 6/2) mottles; moderate, medium, subangular blocky structure; firm when moist; thin dark yellowish-brown (10YR 4/4) clay films on ped faces; strongly acid; clear, smooth boundary.

B22t—34 to 48 inches, yellowish-brown (10YR 5/6) light silty clay loam; common, medium, distinct, pale-brown (10YR 6/3) mottles; moderate, medium to coarse, subangular blocky structure; firm when moist; thin dark yellowish-brown (10YR 4/4) clay films on ped faces; strongly acid; clear, smooth boundary.

C—48 to 70 inches +, yellowish-brown (10YR 5/6) silt loam; light brownish-gray (10YR 6/2) streaks and splotches; massive; friable when moist; slightly acid.

The Ap horizon ranges from dark grayish brown to dark yellowish brown in color. The clay content of the B horizon ranges from 27 to 35 percent. The C horizon is slightly acid to strongly acid. The thickness of the loess deposit ranges from 6 feet to 12 feet or more.

Muren silt loam, 2 to 6 percent slopes, eroded (MuB2).—This soil is on narrow ridges and slopes adjacent to the head of drainageways. From 4 to 6 inches of its surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the yellowish-brown subsoil. Included in mapping were small areas of nearly level soils and small areas of slightly eroded soils.

Corn, soybeans, small grain, hay, and pasture are suitable crops. Crops respond well to lime and fertilizer. Erosion is the major hazard. (Capability unit IIe–3; woodland group 1)

Parke Series

The Parke series consists of deep, well-drained soils that have a medium-textured surface layer and a mod-

underlying material is reddish-yellow, friable, stratified silt loam and fine sand that contains many pebbles.

Permeability is moderate, surface runoff is medium to rapid, and the available moisture capacity is high. The organic-matter content is low. The surface layer is medium acid unless it has been limed.

Moderately sloping and strongly sloping soils of this series occur in this county. The areas are not extensive.

Typical profile of Parke silt loam in a cultivated field, at a point 350 feet east and 85 feet north of the southwest corner of the NE¼NW¼ sec. 26, T. 9 N., R. 10 W.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; moderate, fine, granular structure; friable when moist; medium acid; abrupt, smooth boundary.

B1t—9 to 15 inches, brown to dark-brown (7.5YR 4/4) light silty clay loam; moderate, medium, subangular blocky structure; firm when moist; medium acid; clear, smooth boundary.

B21t—15 to 21 inches, reddish-brown (5YR 4/4) silty clay loam; moderate, medium, subangular blocky structure; firm when moist; few, thin, light yellowish-brown (10YR 6/4) clay films on ped faces; very strongly acid; gradual, smooth boundary.

IIB22tb—21 to 42 inches, reddish-brown (5YR 4/4) to yellowish-red (5YR 4/6) silty clay loam; scattered pebbles in lower portion; moderate, medium and coarse, subangular blocky structure; firm when moist; very strongly acid; gradual, smooth boundary.

IIB21tb—42 to 68 inches, yellowish-red (5YR 4/6) clay loam;

Patton Series

The Patton series consists of deep, very poorly drained soils that have a moderately fine textured surface layer and subsoil. These soils are in depressions on lake terraces. They formed in lacustrine material mantled with loess. The native vegetation consisted of mixed hardwoods, sedges, and swamp grass.

A typical profile has a 13-inch surface layer of silty clay loam, very dark gray in the upper 8 inches and black in the lower part. The subsoil is about 21 inches of firm silty clay loam. The upper 7 inches is dark gray, and the lower part is grayish brown to light brownish gray. The subsoil is mottled throughout. The underlying material is light brownish-gray, mottled, friable, stratified silt loam and silty clay loam.

Permeability is slow, surface runoff is very slow or ponded, and the available moisture capacity is high. The organic-matter content is high.

Nearly level soils of this series occur on lake terraces in the south-central and northwestern parts of this county.

A typical profile of Patton silty clay loam in a cultivated field, at a point 200 feet east and 50 feet north of the southwest corner of the SE¼ sec. 29, T. 7 N., R. 9 W.

Ap—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam; weak, medium, granular structure; friable when moist;

Petrolia Series

The Petrolia series consists of deep, somewhat poorly drained soils that have a moderately fine textured surface layer and subsoil. These soils are on bottom lands

and dark yellowish brown in the lower part. The subsoil is about 31 inches thick. The upper 21 inches is brown, firm sandy clay loam, and the lower part is strong-brown and yellowish-brown, friable heavy sandy loam. The un-

Crops respond well to fertilizer. Erosion is a hazard, and the medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought. (Capability unit IIe–11; woodland group 11)

Princeton fine sandy loam, 6 to 12 percent slopes, eroded (PrC2).—This soil is in areas below ridgetops and adjacent to the head of drainageways. From 4 to 7 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small areas of slightly eroded and severely eroded soils. Also included were small areas that have a surface layer of loamy fine sand.

Ragsdale Series

The Ragsdale series consists of deep, very poorly drained soils that have a medium-textured surface layer and a moderately fine textured subsoil. These soils are on uplands. They formed in silty loess. The native vegetation consisted of mixed swamp forest and swamp grasses.

A typical profile has a 15-inch surface layer of silt loam, very dark brown in the upper 9 inches and very dark grayish brown in the lower part. The subsoil is about 43 inches thick. The upper 19 inches is grayish-brown, mottled, firm silty clay loam. The lower part is yellowish-brown, mottled, firm to friable light silty clay loam. The underlying material is light yellowish-brown and brown-

Reesville Series

The Reesville series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and a moderately fine textured to medium-textured subsoil. These soils are on uplands. They formed in silty loess.

head of drainageways. From 3 to 5 inches of its original surface layer has been lost through erosion. The present surface layer is a mixture of the rest of this original surface layer and some of the brown subsoil. Included in mapping were small tracts of slightly eroded soils and

The Ap horizon ranges from black to very dark gray in color. The B horizon ranges from clay loam to sandy clay

Ap—0 to 8 inches, very dark brown (10YR 2/2) silt loam; moderate, fine, granular structure; friable when moist;

O—½ inch to 0, leaf litter in various stages of decomposition.
A1—0 to 6 inches, very dark grayish-brown (10YR 3/2) loam; weak, medium, granular structure; friable when moist; slightly acid; clear, smooth boundary.
A2—6 to 9 inches, grayish-brown (10YR 5/2) silt loam; few, fine, faint, pale-brown (10YR 6/3) mottles; weak, medium, platy structure; friable when moist; medium acid; clear, smooth boundary.
B1t—9 to 13 inches, light brownish-gray (10YR 6/2) light silty clay loam; many, fine, distinct, yellowish-brown (10YR 5/4) mottles; weak, fine and medium, subangular blocky structure; firm when moist; strongly acid; clear, smooth boundary.
B21t—13 to 20 inches, light brownish-gray (10YR 6/2) silty clay loam; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, angular and subangular blocky structure; firm when moist; few, thin, gray (10YR 5/1) clay films on ped faces; some gray (10YR 6/1) silt along vertical ped faces; strongly acid; clear, smooth boundary.
IIB22t—20 to 29 inches, pale-brown (10YR 6/3) heavy silty clay loam; common, medium, faint, light brownish-gray (10YR 6/2) and common, medium, distinct, strong-brown (7.5YR 5/6) mottles; weak, coarse, angular blocky structure; very firm when moist; strongly acid; abrupt, wavy boundary.
IIR—29 inches +, sandstone and shale bedrock.

In cultivated areas, the color of the surface layer ranges from grayish brown to dark grayish brown. The depth to mottling ranges from 6 to 8 inches. The depth to bedrock ranges from 20 to 34 inches.

Shadeland loam (Sh).—This soil is on benches at the base of steeply sloping soils. The slope range is 0 to 2 percent. A few areas are dissected by small drainageways that carry surface runoff from adjacent soils.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Crops respond well to lime and fertilizer. Wetness and the moderate depth to bedrock are the major limitations. In years when rainfall is less than normal or is poorly distributed, crops are severely damaged by drought. (Capability unit IIIw–7; woodland group 5)

Stendal Series

The Stendal series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has a 10-inch surface layer of grayish-brown to light brownish-gray silt loam. The subsoil is about 20 inches of light brownish-gray, mottled, friable silt loam. The underlying material is light-gray, mottled, friable silt loam.

Permeability is moderate, surface runoff is slow, and the available-moisture capacity is high. The organic

B—10 to 30 inches, light brownish-gray (10YR 6/2) silt loam; many, medium, distinct, brown (10YR 5/3) mottles; weak, medium, granular structure; friable when moist; few to common, medium, black (10YR 2/1) concretions of iron and manganese; strongly acid; gradual, smooth boundary.
C—30 to 55 inches +, light-gray (10YR 7/2) silt loam; many, coarse, faint, gray (10YR 6/1) mottles and common, medium, prominent, yellowish-brown (10YR 5/8) mottles; massive; friable when moist; common, medium, black (10YR 2/1) concretions of iron and manganese; strongly to very strongly acid.

The Ap horizon ranges from very dark grayish brown to grayish brown in color. The depth to mottling ranges from 6 to 14 inches. The C horizon ranges from silt loam to loam and contains thin lenses of sand in some places.

Stendal silt loam (Sn).—This soil is on the bottom lands of small streams. The slope range is 0 to 2 percent. Flooding is likely during winter and early in spring. Included in mapping were small areas of dark-colored, poorly drained soils and a few areas that have a surface layer of loam.

Corn, soybeans, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Small grain and alfalfa are less suitable, because they are severely damaged by flooding. Crops respond well to lime and fertilizer. Flooding is a hazard, and wetness is a limitation. (Capability unit IIw–7; woodland group 13)

Strip Mines

Strip mines (St) include long, narrow mounds of mine spoil (a mixture of soil, till, shale, sandstone, and some coal) and a few open pits. Some of the pits contain water, and some are dry.

The surface material generally consists of heterogeneous soil material, or of large pieces of fractured shale or other rock mixed with coal fragments, or of mixtures of all of these. The material ranges from very strongly acid to neutral. The mounds are nearly level or gently sloping along the top and at the base. They have strongly sloping to very steep sides. Vertical escarpments border at least one side of most pits.

These areas are suitable for trees, wildlife habitat, and recreational facilities. Natural lakes (fig. 5) provide water for wildlife habitat and recreation. In places the spoil can be seeded to grass and legumes and used for pasture. (Capability unit VIIe–3; woodland group 16)

Vigo Series

The Vigo series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and mainly a moderately fine textured subsoil. A very

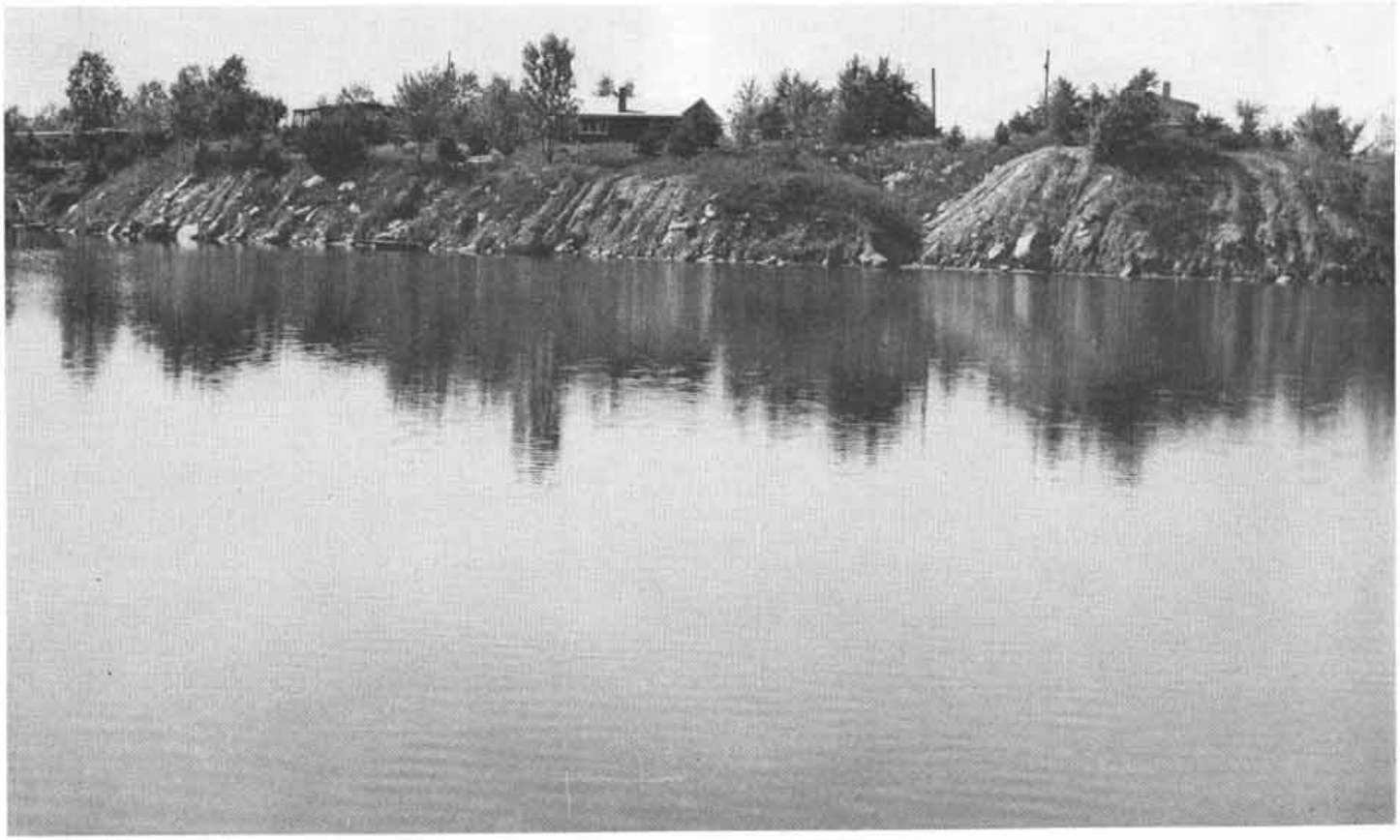


Figure 5.—**Lake formed by strip mining in Cincinnati soils, south of Dugger.**

is light yellowish-brown, mottled, friable clay loam to heavy loam.

Permeability is very slow, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is strongly acid unless it has been limed.

Nearly level soils of this series occur on the uplands in the northeastern part of the county.

moist; light-gray (10YR 7/1) silt films on many ped faces and in cracks and crawfish casts; thick gray (10YR 5/1) clay films on many ped faces; common, medium, black (10YR 2/1) concretions of iron and manganese; strongly acid; gradual, smooth boundary.

B22t—33 to 47 inches, gray (10YR 6/1) silty clay loam; many, medium, distinct, strong-brown (7.5YR 5/6–5/8) mottles; strong, very coarse, prismatic structure; the inside of prisms is structureless; very firm when moist; light-gray (10YR 7/2) silt films on many ped faces and in cracks

ping were small areas of poorly drained soils. Also included were small areas of gently sloping soils.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Alfalfa is less suitable, because the very slowly permeable subsoil restricts the development of roots and the movement of water. Crops respond well to lime and fertilizer. Wetness and very slow permeability are the major limitations. (Capability unit IIIw–3; woodland group 5)

Vigo silt loam, 2 to 4 percent slopes, eroded (VgB2).—This soil is at the head of drainageways, at the base of steep slopes, and on long, uniform slopes. From 5 to 7 inches of its original surface layer has been lost through erosion. The present surface layer contains some of the light brownish-gray subsoil. Included in mapping were small areas of slightly eroded soils.

Corn, soybeans, and small grain can be grown on this soil if a drainage system is established and maintained and erosion is controlled. Hay and pasture are also suitable. The very slowly permeable subsoil restricts the development of roots and the movement of water. Wetness, very slow permeability, and the erosion hazard are the major limitations. (Capability unit IIIw–3; woodland group 5)

Wakeland Series

The Wakeland series consists of deep, somewhat poorly drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was mixed hardwood forest.

A typical profile has an 8-inch surface layer of dark grayish-brown silt loam. The subsoil is about 12 inches of mottled, friable silt loam, light brownish gray in the upper 5 inches and gray to dark yellowish brown in the

C1g—20 to 46 inches, gray (10YR 6/1) silt loam; many, common, medium, distinct, yellowish-brown (10YR 5/4) mottles; massive; friable when moist; common, small, black (10YR 2/1) concretions; neutral; gradual, smooth boundary.

C2g—46 to 55 inches +, gray (10YR 6/1), light brownish-gray (10YR 6/2), and pale-brown (10YR 6/3) silt; massive; friable when moist; neutral.

The Ap horizon ranges from dark grayish brown to brown in color and from neutral to slightly acid in reaction. The underlying material is mainly light silty clay loam to silt loam but contains strata of loam, sandy loam, or sandy clay loam in some areas. The C horizon is slightly acid to neutral.

Wakeland silt loam (Wa).—This soil is on bottom lands along small streams and in slight depressions at the base of uplands along the Wabash River. The slope range is 0 to 2 percent. Flooding is a hazard. Included in mapping were small areas of loam and sandy loam.

Row crops, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Alfalfa and small grain are severely damaged by prolonged floods. Crops respond well to fertilizer. Flooding is a hazard, and wetness is a limitation. (Capability unit IIw–7; woodland group 13)

Warsaw Series

The Warsaw series consists of deep, well-drained soils that have a medium-textured or moderately coarse textured surface layer and a moderately fine textured subsoil. These soils are on terraces. They formed in 24 to 42 inches of outwash over gravel and sand (fig. 6). The native vegetation was prairie grass.

A typical profile has a 14-inch surface layer of loam, very dark brown in the upper 7 inches and dark brown in the lower part. The subsoil is about 22 inches thick. The upper 16 inches is mostly dark-brown, firm gravelly sandy clay loam. The lower part is dark-brown and yel-

Typical profile of Westland silty clay loam in a cultivated field, at a point 130 feet east and 250 feet north of the southwest corner of the NE¼ sec. 11, T. 6 N., R. 10 W.

Ap—0 to 7 inches, very dark brown (10YR 2/2) silty clay loam; moderate, fine, subangular blocky structure; friable when moist; neutral; abrupt, smooth boundary.

A1—7 to 13 inches, very dark gray (10YR 3/1) silty clay loam; moderate, medium, subangular blocky structure; firm when moist; neutral; gradual, wavy boundary.

B21tg—13 to 26 inches, dark-gray (10YR 4/1) heavy silty clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, prismatic structure breaking to moderate, medium, angular blocky; firm when moist; few very dark gray (10YR 3/1) clay films on ped faces; few pebbles, increasing in number with depth; neutral; clear, wavy boundary.

B22tg—26 to 44 inches, gray (10YR 5/1) gravelly clay loam; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; moderate, medium, prismatic structure breaking to moderate, medium and coarse, subangular blocky; firm when moist; few dark yellowish-brown (10YR 4/4) clay films on ped faces; neutral; clear, smooth boundary.

B3g—44 to 52 inches, gray (10YR 5/1) sandy clay loam; some gravel; many, medium, distinct, yellowish-brown (10YR 5/4) mottles; massive; firm when moist; neutral to mildly alkaline; clear, wavy boundary.

IIC—52 to 65 inches +, gray (10YR 6/1), brown (10YR 5/3), and light yellowish-brown (10YR 6/4), stratified gravel and sand; single grain; loose; calcareous.

The Ap horizon ranges from black to very dark gray or very dark brown in color. The A horizon ranges from 10 to 16 inches in thickness. The depth to loose sand and gravel ranges from 42 to 60 inches.

Westland silty clay loam (Wt).—This soil is in depressions on outwash terraces near the Wabash River, mainly in the southwestern part of the county. The slope range is 0 to 2 percent. Included in mapping were small areas of silt loam.

Corn, soybeans, small grain, hay, and pasture can be grown on this soil if a drainage system is established and maintained. Wetness is the major limitation. (Capability unit IIw–1; woodland group 11)

Westland silty clay loam, shallow variant (Wv).—This soil is on outwash terraces, mainly in the northwestern part of the county. It differs from normal Westland silty clay loam in that the depth to bedrock is only 20 to 42 inches.

All the crops commonly grown in this county can be grown on this soil if a drainage system is established and maintained. The limited depth to bedrock makes drainage difficult. Corn, soybeans, small grain, and hay are the main crops. Alfalfa is less suitable, because of a high water table and a frost-heave hazard during winter and early in spring. Crops respond well to fertilizer. Wetness and the limited depth to bedrock are the major limitations. (Capability unit IIIw–5; woodland group 11)

Wilbur Series

The Wilbur series consists of deep, moderately well drained soils that have a medium-textured surface layer and subsoil. These soils are on bottom lands. They formed in alluvium. The native vegetation was a mixed hardwood forest.

A typical profile has a surface layer of dark grayish-brown silt loam about 9 inches thick. The subsoil is about 33 inches of brown, friable silt loam; the lower part is mottled. The underlying material is pale-brown, friable silt.

Permeability is moderate, surface runoff is slow, and the available moisture capacity is high. The organic-matter content is low. The surface layer is neutral to slightly acid.

Nearly level soils of this series occur on bottom lands along small tributaries of the Wabash River in the western half of this county.

Typical profile of Wilbur silt loam in a cultivated field, at a point 70 feet east and 150 feet south of the northwest corner of sec. 3, T. 7 N., R. 10 W.

Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; friable when moist; neutral; abrupt, smooth boundary.

B21—9 to 20 inches, brown (10YR 5/3) silt loam; weak, medium, granular structure; friable when moist; clear, smooth boundary.

B22—20 to 42 inches, brown (10YR 5/3) silt loam; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive to very weak, medium, granular structure; friable when moist; neutral; clear, smooth boundary.

C—42 to 50 inches +, pale-brown (10YR 6/3) silt; common, medium, distinct, gray (10YR 6/1) and yellowish-brown (10YR 5/8) mottles; massive; friable when moist; few, medium, very dark brown (10YR 2/2) concretions of iron and manganese; neutral.

The Ap horizon ranges from dark grayish brown to brown in color. The depth to mottling ranges from 16 to 24 inches. The B horizon is 20 to 36 inches thick. The C horizon is silt to silt loam, and in places it contains lenses of fine sand. The reaction is slightly acid to mildly alkaline.

Wilbur silt loam (Ww).—This soil occurs as narrow areas on bottom lands along creeks. The slope range is 0 to 2 percent. Flooding is likely in spring. Included in mapping were a few small areas of somewhat poorly drained soils.

Corn, soybeans, hay, and pasture are suitable crops. Small grain is less suitable, because it is damaged by flooding. Crops respond well to fertilizer. Flooding is the major hazard, and wetness is a slight limitation. (Capability unit I–2; woodland group 8)

Zipp Series

The Zipp series consists of deep, very poorly drained soils that have a fine-textured surface layer and subsoil. These soils are on lake terraces and old river channels. They formed in water-deposited clayey sediment. The native vegetation was swamp forest.

A typical profile has an 8-inch surface layer of very dark grayish-brown silty clay. The subsoil is about 23 inches of dark-gray, mottled, very firm silty clay to clay. The underlying material is clay. The upper 29 inches is dark gray to gray, mottled, and very firm. The rest is gray to yellowish brown, mottled, and very plastic.

Permeability is very slow, surface runoff is very slow or ponded, and the available moisture capacity is high. The organic-matter content is high.

Soils of this series occur in depressions on lake terraces and in old stream channels along the Wabash River.

Typical profile of Zipp silty clay in a cultivated field, at a point 80 feet east and 50 feet south of the northwest corner of the SE¼NW¼ sec. 26, T. 6 N., R. 10 W.

Ap—0 to 8 inches, very dark grayish-brown (10YR 3/2) silty clay; moderate, medium and coarse, angular blocky structure; firm when moist; slightly acid; clear, smooth boundary.

B2g—8 to 31 inches, dark-gray (10YR 4/1) silty clay to clay; common, medium, distinct, dark-brown (7.5YR 4/4) mottles; moderate, very coarse, angular blocky structure; very firm when moist; slightly acid; clear, smooth boundary.

C1—31 to 60 inches, dark-gray (10YR 4/1) to gray (10YR 5/1) clay; many, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive; very firm when moist; neutral; gradual, wavy boundary.

C2—60 to 70 inches +, gray (10YR 6/1) to yellowish-brown (10YR 5/6) clay; common, medium, gray (N 5/0) mottles; massive; very plastic; calcareous.

The Ap horizon ranges from very dark grayish brown to dark gray in color, and the B2 horizon from dark gray to gray. The C horizon is mainly silty clay to clay, but in some places it contains thin layers of silty clay loam or clay loam and an occasional layer of sandy clay loam.

Zipp silty clay (Zc).—This soil is in depressions on lake terraces and in old river channels near the Wabash River

soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I, II, III, IV, V, VI, VII, and VIII

this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are

CAPABILITY UNIT IIe-3

This unit consists of deep, gently sloping soils of the Alford, Iona, and Muren series. These soils are well drained or moderately well drained and are medium textured. They are on uplands in all parts of the county except the northeastern.

The soils of this unit are moderately eroded. The organic-matter content is low. The surface layer is medium acid unless it has been limed. The available moisture capacity is high. Permeability is moderate or moderately slow. Erosion is a moderate hazard, and the low organic-matter content is a limitation.

These soils are suited to all the crops commonly grown

content is a problem with all the soils except the Cory. crops help to increase the organic-matter content and to

slightly acid to medium acid unless it has been limed. Wetness is a moderate limitation.

If artificially drained, this soil is suited to all the crops commonly grown in the county. Corn and soybeans are

medium-textured soils of the Alford and Iona series. These soils occur on uplands in all parts of the county except the northeastern.

The soils of this unit are moderately and severely

Ade and Bloomfield series. These soils are on uplands above the Wabash River in the western part of the county.

The available moisture capacity of these soils is low, and permeability is rapid. The plow layer is medium acid unless it has been limed. The Ade soil is high in organic-matter content, and the Bloomfield soil is low. For both soils, erosion is a severe hazard and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought.

These soils are suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Apples, peaches, melons, and other specialty crops also can be grown.

Use of crop residue and use of green-manure crops are ways to return organic matter. These practices also help to conserve moisture. Contour cultivation, minimum tillage, and winter cover crops help to control erosion.

CAPABILITY UNIT IIIe-13

This unit consists of deep, gently sloping and moderately sloping, well-drained, moderately coarse textured soils of the Elston, Fox, Princeton, and Warsaw series. These soils are underlain at a depth of more than 24 inches by sand or by gravel and sand. They occur in the western part of the county. The Princeton soil is on uplands, and the other soils are on terraces.

The organic-matter content of the Fox and Princeton soils is low, and that of the Elston and Warsaw soils is high. The available moisture capacity of all the soils is low to medium. Permeability is moderate to rapid. The plow layer is medium acid unless it has been limed. Erosion is a severe hazard, and the low to medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought.

These soils are suited to all the crops commonly grown

form. When dry, these clods are very difficult to work down. Flooding is a severe hazard on the Zipp soil.

If artificially drained, the soils of this unit are suited to all the crops commonly grown in the county. Corn, soybeans, and hay are the main crops. Small grain and alfalfa are damaged by the high water table in winter and early in spring. Minimum tillage, plowing in fall, and use of crop residue, along with cultivation when moisture conditions are favorable, help to maintain good tilth.

CAPABILITY UNIT IIIw-3

This unit consists of deep, nearly level and gently sloping, somewhat poorly drained, medium-textured soils of the Vigo series. These soils are on uplands in the northeastern part of the county.

The organic-matter content of these soils is low. The surface layer is strongly acid unless it has been limed. The available moisture capacity is high. Permeability is very slow. A claypan is at a depth of 18 to 24 inches. Wetness is a severe limitation. Erosion is a hazard on slopes of more than 2 percent.

These soils are suited to most of the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Alfalfa is not well suited, because the claypan restricts the root zone.

Crop residue and green-manure crops can be used to return organic matter. Minimum tillage, contour cultivation, diversion terraces, and grassed waterways are needed to help control erosion on slopes of more than 2 percent.

CAPABILITY UNIT IIIw-5

Westland silty clay loam, shallow variant, is the only soil in this unit. It is a deep, very poorly drained, moderately fine textured soil on outwash terraces, mainly in the northwestern part of the county. The slope range is 0 to 2 percent. The depth to bedrock is 20 to 42 inches.

The organic-matter content of this soil is high, the available moisture capacity is high, and permeability is

tillage, use of crop residue, and use of green-manure crops help to increase the organic-matter content and maintain good tilth.

CAPABILITY UNIT IIIw–7

Shadeland loam is the only soil in this unit. It is a moderately deep, somewhat poorly drained, medium-textured soil on benches in the northwestern part of the county. The slope range is 0 to 2 percent. The depth to bedrock is 20 to 42 inches.

The organic-matter content of this soil is low. The surface layer is strongly acid unless it has been limed. The available moisture capacity is medium or low, and permeability is slow. Wetness is a severe limitation.

If artificially drained, this soil is suited to most of the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought.

Minimum tillage, use of crop residue, and use of green-manure crops help to maintain or increase the organic-matter content and to conserve moisture.

CAPABILITY UNIT IIIw–10

Atkins silt loam is the only soil in this unit. It is a [redacted]

CAPABILITY UNIT IIIs–2

This unit consists of deep, nearly level, well-drained, moderately coarse textured soils of the Fox, Elston, and Warsaw series. These soils are underlain at a depth of more than 24 inches by sand or by gravel and sand. They are on terraces in the western part of the county near the Wabash River.

The organic-matter content of these soils is low to high. The plow layer is medium acid unless it has been limed. The available moisture capacity is low to medium, and permeability is moderate. The low to medium available moisture capacity is a severe limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to damage from drought.

These soils are suited to all the crops commonly grown in the county. Corn, soybeans, small grain, hay, and pasture are the main crops. Potatoes, tomatoes, green beans, and other vegetables can be grown under irrigation.

Crop residue and green-manure crops can be used to return organic matter. Increasing the organic-matter content, in combination with minimum tillage and planting early in spring, helps to conserve moisture and to prevent drought damage to crops.

CAPABILITY UNIT IVe–3

This unit consists of deep, moderately sloping and [redacted]

Minimum tillage, use of crop residue, contour cultivation, diversion terraces, and grassed waterways help to control runoff and erosion. Winter cover crops and green-manure crops can be used to return organic matter.

CAPABILITY UNIT IVe–12

Bloomfield loamy fine sand, 12 to 18 percent slopes, is the only soil in this unit. It is a deep, somewhat excessively drained, coarse-textured soil that occurs on uplands, as a narrow band that roughly parallels the Wabash River.

The organic-matter content of this soil is low. The surface layer is medium acid unless it has been limed. Permeability is rapid, and the available moisture capacity is low. Erosion is a very severe hazard, and the low available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought. This soil is suited to small grain, alfalfa, hay, orchard crops, and melons.

Minimum tillage, use of crop residue, and use of green-manure crops help to increase and maintain the organic-matter content. These practices also help to prevent drought damage to crops. Contour cultivation and winter cover crops help to control erosion.

CAPABILITY UNIT IVe–15

Princeton fine sandy loam, 12 to 18 percent slopes, eroded, is the only soil in this unit. It is a deep, well-drained, moderately coarse textured soil on uplands in the western part of the county.

The soil of this unit is slightly or moderately eroded. The organic-matter content is low. The surface layer is medium acid unless it has been limed. Permeability is moderate, and the available moisture capacity is medium. Erosion is a very severe hazard, and the medium available moisture capacity is a limitation. In years when rainfall is less than normal or is poorly distributed, crops are subject to severe damage from drought.

This soil is well suited to alfalfa and orchard crops. It is also suited to small grain, hay, and pasture. Only an occasional row crop should be grown.

Crop residue and green-manure crops can be used to return organic matter. Increasing the organic-matter content. Plowing for preparation of seedbeds should be on the contour. Pastures should not be overgrazed. A permanent cover of vegetation helps to control runoff and erosion.

CAPABILITY UNIT VIe–3

Bloomfield loamy fine sand, 18 to 40 percent slopes, is the only soil in this unit. It is a deep, somewhat excessively drained, coarse-textured soil on escarpments and breaks. It occurs on the uplands in the western part of the county and is roughly parallel to the Wabash River.

The soil of this unit is slightly or moderately eroded. The organic-matter content is low. The surface layer is medium acid unless it has been limed. Permeability is rapid, and the available moisture capacity is low. Erosion is a very severe hazard, and the low available moisture capacity is a limitation.

This soil is suited to permanent pasture and to trees. In years when rainfall is less than normal or is poorly distributed, pasture yields are generally low.

A permanent cover of vegetation helps to control erosion. Pastures must not be overgrazed.

CAPABILITY UNIT VIIe–1

This unit consists of Hickory silt loam, 35 to 50 percent slopes, and of Rock land. These soils are slightly eroded and moderately eroded. They are on deeply dissected uplands. The Hickory soil is deep, medium textured, and well drained. It occurs on escarpments and side slopes, mostly in the eastern and northern parts of the county. Rock land is shallow to moderately deep, steep to very steep, and well drained to somewhat excessively drained. It occurs as a long, narrow band that begins at Merom and extends northward to the county line.

The Hickory soil of this unit is moderately permeable and has a high available moisture capacity. Rock land is moderately permeable and has a low available moisture capacity. Erosion is a very severe hazard.

Most of this unit is suited to trees, but some of the less steep areas are suited to permanent pasture. Pastures should not be overgrazed.

CAPABILITY UNIT VIIe–3

This unit consists only of Strip mines, a land type

CAPABILITY UNIT VIIIs-1

This unit is made up of Mine dumps and Riverwash. Mine dumps are piles of waste from shaft mines and from loading points where coal is cleaned and sorted. Riverwash consists of assorted sand and gravel on islands and sandbars along the Wabash River.

These land types are not suited to farming. Much of the mine waste is too acid to support plants. Riverwash and sufficiently leached areas of Mine dumps produce a limited amount of vegetation. They are suitable for development as wildlife habitat.

Estimated Yields

Table 2 shows average yields per acre of the principal crops, under two levels of management. The figures in columns A represent yields that can be expected under an average, or medium, level of management. Those in columns B represent yields that can be expected under an improved, or high, level of management.

The following are assumed to be part of an average management system:

1. Using cropping systems that maintain tilth and organic-matter content.
2. Controlling erosion well enough to prevent serious impairment of the quality of the soil.
3. Applying fertilizer and lime in moderate amounts, if need is indicated by soil tests.
4. [illegible] of the crop residue to the soil.
7. Controlling weeds fairly well by tillage and spraying.
8. Draining wet soils well enough to allow cropping but not always well enough to prevent limitation of yields.

The following are assumed to be part of an improved management system:

1. Using cropping systems that maintain tilth and organic-matter content.
2. Controlling erosion to the maximum extent possible, so that qualities of the soil will be maintained or improved, rather than impaired.
3. Maintaining a high level of fertility by means of frequent soil tests and use of fertilizer in accordance with recommendations of the State Agricultural Experiment Station.
4. Liming soils in accordance with the results of soil tests.
5. Using crop residue to the fullest extent to protect and improve the soil.
6. Following minimum tillage practices.
7. Planting only the crop varieties that are best adapted to the soils and climate.
8. Controlling weeds thoroughly by tillage and spraying.
9. Draining wet areas well enough that wetness does not restrict yields.

The estimates in table 2 are averages for a period of 5 to 10 years. They are based on farm records, on inter-

TABLE 2.—*Estimated average yields per acre of principal crops under two levels of management*—Continued

Soil	Corn		Soybeans		Wheat		Mixed hay		Alfalfa	
	A	B	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
Cincinnati silt loam, 6 to 12 percent slopes, eroded	40	65	20	30	20	27	2.0	3.0		
Cincinnati silt loam, 6 to 12 percent slopes, severely eroded	40	60	18	25	18	25	1.5	2.5		
Cincinnati silt loam, 12 to 18 percent slopes, eroded	35	60			20	30	2.0	2.5		
Cincinnati silt loam, 12 to 18 percent slopes, severely eroded							1.5	2.5		
Cory silt loam	75	100	30	40	30	35	2.0	3.0	2.5	4.0
Cuba silt loam	70	100	28	40	32	40	2.0	3.0	2.5	4.0
Eel silt loam	65	100	30	40	30	35	2.5	4.0	2.5	4.0
Elston fine sandy loam, 0 to 2 percent slopes	65	75	20	30	30	42	1.5	2.5	2.5	3.5
Elston fine sandy loam, 2 to 6 percent slopes	65	75	20	30	30	42	1.5	2.5	2.5	3.5
Elston loam, 0 to 2 percent slopes	70	85	20	30	30	42	2.0	3.0	2.5	3.5
Elston loam, 2 to 6 percent slopes	70	80	20	30	30	42	2.0	3.0	2.5	3.5
Fox sandy loam, 0 to 2 percent slopes	50	70	20	30	30	40	1.5	2.0	2.0	3.2
Fox sandy loam, 2 to 6 percent slopes	50	70	20	30	28	37	1.5	2.0	2.0	3.2
Fox loam, 0 to 2 percent slopes	70	85	20	30	30	42	2.0	3.0	2.5	3.5
Genesee silt loam	70	100	28	40	32	40	2.0	3.0	2.5	4.0
Genesee fine sandy loam, eroded										

somewhat poorly drained bottom-land soils. The Stendal soils, for example, are well suited to sweetgum and associated species. Associated species include soft maple, red

the Forest Service in 1957, but unpublished; for pin oak, from age-height data for sweetgum given in the Forestry Handbook, published in 1955 by the Society of American

able replanting, special preparation of seedbed, and use of superior planting techniques are required to assure satisfactory stands.

Erosion hazard refers to the risk when the soil is used for production of woodland crops.

Windthrow hazard depends on soil characteristics that control development of tree roots and affect windfirmness (fig. 10). The rating is slight if there is no special problem and individual trees can be expected to remain standing if released on all sides; moderate if development of roots is adequate for stability except during periods of excessive soil wetness or high wind; and severe if development of roots is not adequate for stability and individual trees can be expected to blow over if released on all sides.

Equipment limitation is rated on the basis of soil characteristics that restrict or prohibit the use of equipment commonly used for tending and harvesting the woodland crop. The limitation is slight if there is no restriction on the kind of equipment used or on the time of year it can be used; moderate if there is a seasonal restriction of less than 3 months or if there is a moderate restriction caused by slope, wetness, stoniness, or other physical characteristics; and severe if there is a seasonal restriction of more than 3 months when equipment cannot be used or if there are other severe restrictions caused by steep slopes, wetness, stoniness, or numerous gullies.

The trees listed as *most desirable species in natural stands* are those that have the most rapid growth rate combined with the highest value and marketability.

Suitable species for planting are listed in order of priority of preference. This is not a complete list of suitable trees.

Wildlife [3]

A well-planned and well-managed system of farming that maintains the soils will provide food and cover for wildlife. Farming that depletes the soils eliminates food and cover and thus reduces the potential population of desirable species of wildlife. An unbalanced wildlife population leads to an increase in the number of destructive insects, rodents, and other undesirable animal life.

On most farms, the wildlife habitat can be improved by practices that supply or increase food and cover (*9*). To get the maximum wildlife population on a farm, as

[3] By JAMES MCCALL, biologist, USDA, Soil Conservation Service.

the soils for woodland

enough on the soils of the given group to be a major crop]

Erosion hazard	Windthrow hazard	Equipment limitation	Most desirable species in natural stands	Species suitable for planting
Slight to moderate	Slight	Slight to moderate	Tulip-poplar, white ash, red oak, black walnut, and white oak.	White pine, shortleaf pine, black locust, and red pine.
Slight to severe	Slight	Slight to moderate (slopes are steep and short).	Tulip-poplar, white ash, red oak, black walnut, and white oak.	White pine, shortleaf pine, black locust, Virginia pine, and red pine.
Severe	Slight	Severe	Few, if any, existing stands; planting mainly to control erosion.	Black locust, red pine, white pine, Virginia pine, and shortleaf pine.
Moderate to severe	Slight	Severe	Red oak, white oak, black oak, tulip-poplar, and black walnut.	White pine, red pine, shortleaf pine, and black locust.
Slight	Moderate to severe	Moderate	Sweetgum, pin oak, soft maple, white ash, tulip-poplar, and swamp white oak.	White pine, sweetgum, soft maple, and sycamore.
Slight	Slight	Slight	Cottonwood, sycamore, tulip-poplar, black walnut, white ash, and southern red oak.	White pine, cottonwood, black locust, sycamore, and black walnut.
Slight to moderate	Moderate	Slight	White oak, white ash, tulip-poplar, and black oak.	White pine, red pine, shortleaf pine, and Virginia pine.
Slight	Moderate to severe	Severe	Sweetgum, pin oak, soft maple, bur oak, white ash, tulip-poplar, and swamp white oak.	Planting very rarely needed.
Slight	Moderate	Moderate	Sweetgum, pin oak, soft maple, tulip-poplar, and ash.	White pine, cottonwood, sycamore, and sweetgum.
Moderate	Slight	Slight to moderate	Black oak, tulip-poplar, red oak, white oak, and black walnut.	White pine, shortleaf pine, and Virginia pine.
Slight to moderate	Slight	Severe	Cottonwood, sycamore, soft maple and green ash.	Virginia pine, shortleaf pine, and white pine.
Slight to moderate	Slight	Moderate	White oak, black oak, and bur oak.	White pine, shortleaf pine, and black locust.
Moderate	Moderate to severe	Moderate to severe	Chestnut oak, white oak, and Virginia pine.	Shortleaf pine, Virginia pine, pitch pine, and loblolly pine.
				White pine, red pine, Norway spruce, and arborvitae.

ducks may be found on bottom lands along the Wabash River in areas of Genesee, Eel, and Wakeland soils. Wood ducks commonly nest in hollow trees and compete with raccoons for trees near water where they can raise a brood of young. A few mallards and blue-winged teals nest in open idle areas and meadows near water. Mallards

The Outdoor Recreation Resources Review Commission predicts that the need for outdoor recreational facilities will greatly increase during the latter half of the twentieth century (*3*). The Commission recommends that land-use planning include planning for outdoor recreation.

Well-drained soils in upland areas are well suited for

TABLE 4.—*Engineering*

[Tests performed by Purdue University in cooperation with Indiana State Highway Department and the American Association of State

Soil name and location of sample	Parent material	Purdue report No.	Depth	Moisture-density data[1]		California bearing ratio test[2]			
				Maximum dry density	Optimum moisture	Molded specimen		CBR	Swell
						Dry density	Moisture content		

test data

U.S. Department of Commerce, Bureau of Public Roads, in accordance with standard procedures of Highway Officials (AASHO) (*1*)]

Mechanical analysis [3]								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—				Percentage smaller than—						AASHO	Unified [4]
No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
								Pct.			
	100	98	90	86	60	23	15	30	8	A–4(8)	ML–CL
		100	96	92	71	36	30	44	19	A–7–6(12)	ML–CL
	100	98	87	81	60	27	22	34	15	A–6(10)	CL
	100	99	91	88	63	28	20	30	10	A–4(8)	CL
		100	90	84	64	35	30	40	22	A–6((13)	CL
		100	93	89	62	28	22	31	11	A–6(8)	CL
		100	95	92	70	29	19	31	11	A–6(8)	CL
		100	97	93	71	36	29	43	20	A–7–6(13)	CL
	100	99	85	78	56	26	19	27	9	A–4(8)	CL

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Ft.	*In.*			
Ade: AdB, AdC	More than 10.	0–19	Loamy fine sand	SM	A–2
		19–35	Fine sand	SM	A–2
		35–60	Fine sand with lenses of sandy loam to sandy clay loam.	SM	A–2
		60–70	Loose fine sand	SM	A–2
Alford: AfB2, AfB3, AfC2, AfC3, AfD2, AfD3, AfE, AfF.	More than 10.	0–15	Silt loam	ML or CL	A–4
		15–36	Light silty clay loam	CL or ML–CL	A–6 or A–7
		36–63	Silt loam	CL	A–6
Atkins: [1] Ak	Less than 1.	0–45	Silt loam and loam	ML or CL	A–4
Ava: AlA, AlB2, AlB3	More than 10.	0–22	Silt loam to light silty clay loam	ML or CL	A–4 or A–6
		22–48	Silty clay loam	CL	A–6
		48–55	Gritty silt loam	ML or CL	A–4
		55–100	Loam till	ML	A–4
Ayrshire: AsA, AsB, AyA	2 or less.	0–18	Fine sandy loam and loam	ML	A–4

engineering properties

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
No. 10	No. 40	No. 200					
			In. per hr.	*In. per in. of soil*	*pH*		
95–100	90–100	10–20	5. 0–10. 0	0. 07	6. 0–6. 5	Low	Low.
95–100	90–100	10–20	5. 0–10. 0	. 04	5. 5–6. 0	Low	Low.
95–100	60–70	10–20	5. 0–10. 0	. 06	5. 5–6. 0	Low	Low.
95–100	60–70	10–20	5. 0–10. 0	. 05	6. 1–7. 8	Low	Low.
95–100	95–100	85–95	0. 8–2. 5	. 20	5–5–6. 5	Moderate to high	Low.
95–100	95–100	85–95	0. 8–2. 5	. 18	5. 0–5. 5	Moderate to high	Moderate.
95–100	95–100	85–95	0. 8–2. 5	. 20	6. 0–6. 5	Moderate to high	Moderate.
95–100	90–100	70–80	0. 8–2. 5	. 21	5. 0–6. 0	Moderate to high	Low to moderate.
95–100	90–95	90–95	0. 8–2. 5	. 20	5. 1–6. 0	Moderate	Low to moderate.
95–100	90–95	80–90	0. 2–0. 8	. 18	4. 6–5. 5	Moderate	Moderate.
95–100	85–95	80–90	0. 05–0. 2	. 16	5. 1–5. 5	Moderate	Low to moderate.
95–100	75–85	60–70	0. 8–2. 5	. 18	5. 1–6. 6	Moderate	Low.
95–100	85–95	55–65	0. 8–2. 5	. 16	5. 6–6. 5	Moderate	Low.
95–100	65–75	35–45	0. 8–2. 5	. 18	5. 6–6. 5	Moderate	Moderate to low.
95–100	65–75	30–40	0. 8–2. 5	. 16	7. 4–7. 8	Moderate	Low.
95–100	80–85	10–15	5. 0–10. 0	. 07	5. 5–6. 5	Low	Low.
95–100	80–85	10–15	5. 0–10. 0	. 08	5. 5–6. 0	Low	Low.
95–100	80–85	10–15	>10. 0	. 05	7. 4–7. 8	Low	Low.
			0. 8–10. 0	. 25	6. 0–6. 5	Low	Low.
95–100	90–95	90–95	0. 8–2. 5	. 20	5. 6–6. 0	Moderate	Low to moderate.
95–100	90–95	80–90	0. 2–0. 8	. 18	5. 1–5. 5	Moderate	Moderate to high.
95–100	85–95	80–90	0. 05–0. 2	. 16	5. 1–5. 5	Moderate	Moderate to high.
95–100	70–80	60–70	0. 8–2. 5	. 18	5. 6–6. 0	Moderate	Moderate to high.
95–100	75–85	60–70	0. 8–2. 5	. 18	5. 6–7. 8	Moderate	Moderate to high.
100	90–100	75–85	0. 8–2. 5	. 23	5. 5–6. 0	Moderate	Moderate.
100	90–100	85–95	0. 8–2. 5	20	4. 5–5. 0	Moderate	Moderate.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Ft.	*In.*			
Gullied land: Gu. Properties were not estimated.					
Henshaw: HeA, HeB2	1 to 2.	0–12	Silt loam	ML	A–4
		12–42	Silty clay loam	CL	A–7 or A–6
		42–60	Stratified silty clay loam and silt loam.	CL or ML	A–4
Hickory: HkE, HkF, HkF3, HkG	More than 10.	0–11	Silt loam	ML	A–4
		11–50	Gritty silty clay loam to clay loam.	CL	A–7 or A–6
		50–60	Loam till	CL	A–6
Iona: IoA, IoB2, IoB3	More than 10.	0–7	Silt loam	ML	A–4
		7–34	Silty clay loam	CL	A–7 or A–6
		34–50	Silt loam	ML	A–4
Iva: IvA, IvB2	2 to 4.	0–17	Silt loam	ML or CL	A–4 or A–6
		17–40	Silty clay loam	CL	A–7 or A–6
		40–50	Silt loam	CL	A–6
Kings: Kg	Less than 1.	0–16	Silty clay	CH or OH	A–7
		16–37	Silty clay	CH	A–7
		37–60	Silty clay	CH	A–7
Lyles: Ly	1 to 2.	0–16	Loam	ML or OL	A–4
		16–28	Heavy loam	CL	A–4
		28–38	Stratified light sandy clay loam and fine sandy loam.	SC	A–4 or A–6
		38–50	Fine sand stratified with loam to sandy clay loam.	SP–SM	A–3
Markland: MaB2, MaD2, MaE2, McD3.	More than 10.	0–10	Silt loam to light silty clay loam.	ML or CL	A–6
		10–26	Silty clay	CH	A–7
		26–42	Clay or silty clay	CH	A–7
McGary: Mg	1 to 2.	0–11	Silt loam	ML	A–4
		11–40	Silty clay loam to silty clay	CH or CL	A–7 or A–6
		40–50	Silty clay	CH	A–7
Mine dumps: Mn. Properties were not estimated.					
Muren: MuB2	More than 10.	0–11	Silt loam	ML	A–4
		11–48	Light silty clay loam to silty clay loam.	CL	A–6 or A–7
		48–70	Silt loam	ML	A–4
Parke: PaC3, PaD3	More than 10.	0–15	Silt loam to light silty clay loam.	ML or CL	A–4 or A–6
		15–42	Silty clay loam	CL	A–6
		42–106	Clay loam	CL	A–6
		106–110	Stratified silt loam and fine sand.	SM	A–2
		110	Sandstone and shale.		
Patton: Pc	1 to 2.	0–20	Silty clay loam	CL	A–6
		20–34	Silty clay loam	CL	A–6 or A–7
		34–48	Stratified silt loam and silty clay loam.	CL	A–6
Petrolia:[1] Po	1 to 2.	0–8	Silty clay loam	CL	A–6
		8–23	Silty clay loam	CL	A–6 or A–7
		23–42	Light silty clay loam and silt loam.	CL	A–6
Princeton: PrA, PrB2, PrC2, PrD2 PrE2, PrG.	More than 10.	0–11	Fine sandy loam	SM	A–4
		11–30	Sandy clay loam	SM	A–4
		30–42	Sandy loam	SM	A–2
		42–60	Fine sand and coarse silt	SM–SP	A–2 or A–3

See footnotes at end of table.

engineering properties—Continued

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
No. 10	No. 40	No. 200					
			In. per hr.	*In. per in. of soil*	*pH*		
95–100	95–100	75–85	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Low.
95–100	90–100	85–95	0. 05–0. 2	. 19	5. 0–5. 5	Moderate	Moderate to high.
95–100	90–100	80–90	0. 2–0. 8	. 19	6. 6–7. 3	Moderate	Moderate to high.
95–100	90–95	90–95	0. 8–2. 5	. 20	4. 5–5. 0	Moderate	Low.
95–100	95–100	80–90	0. 8–2. 5	. 18	5. 1–6. 0	Low	Low.
95–100	75–85	60–70	0. 8–2. 5	. 18	7. 4–7. 8	Low	Low.
95–100	95–100	75–90	0. 8–2. 5	. 20	5. 5–6. 0	Moderate	Low.
95–100	95–100	85–95	0. 2–0. 8	. 18	5. 0–6. 0	Moderate to high	Moderate to high.
95–100	90–100	80–90	0. 8–2. 5	. 19	6. 5–7. 8	Moderate to high	Moderate.
95–100	90–100	90–95	0. 8–2. 5	. 20	6. 0–6. 5	Moderate to high	Moderate to high.
95–100	95–100	85–95	0. 05–0. 2	. 18	5. 5–6. 0	Moderate to high	Moderate to high.
95–100	95–100	75–85	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Moderate to high.
	100	90–100	<0. 05	. 18	6. 5–7. 3	High	High.
	100	90–100	<0. 05	. 15	6. 5–7. 3	High	High.
	100	90–100	<0. 05	. 15	7. 4–7. 8	High	High.
95–100	75–85	65–75	0. 8–2. 5	. 18	6. 6–7. 3	Moderate to high	Low.
95–100	80–90	65–75	0. 8–2. 5	. 18	6. 6–7. 3	Moderate	Low.
95–100	65–75	35–45	0. 8–2. 5	. 18	7. 4–7. 8	Moderate	Low.
95–100	50–60	10–20	2. 5–5. 0	. 13	7. 4–7. 8	Low to moderate	Low.
100	90–100	80–90	0. 8–2. 5	. 20	6. 6–7. 3	Moderate	Moderate.
100	95–100	85–95	0. 05–0. 2	. 18	6. 6–7. 3	Moderate	High.
100	95–100	90–100	0. 05–0. 2	. 16	7. 4–7. 8	Moderate	High.
100	90–100	80–90	0. 8–2. 5	. 20	6. 6–7. 3	Moderate	Low.
100	95–100	85–95	<0. 05	. 15	5. 6–6. 5	Moderate	High.
100	95–100	90–100	<0. 05	. 16	7. 4–7. 8	Moderate	High.
95–100	95–100	85–95	0. 8–2. 5	. 20	5. 5–6. 0	Moderate to high	Low.
95–100	95–100	85–95	0. 8–2. 5	. 18	5. 5–6. 0	Moderate to high	Moderate to high.
95–100	95–100	85–95	0. 8–2. 5	. 20	6. 5–7. 3	Moderate to high	Moderate.
95–100	95–100	75–85	0. 8–2. 5	. 20	5. 6–6. 0	Moderate to high	Low.
95–100	95–100	85–95	0. 8–2. 5	. 18	4. 5–5. 5	Moderate	Moderate to high.
95–100	90–100	65–75	0. 8–2. 5	. 18	4. 5–5. 5	Moderate	Moderate to high.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Ft.	*In.*			
Ragsdale: Ra	1 to 2.	0–15	Silt loam	ML	A–6
		15–34	Silty clay loam	CL or CH	A–6 or A–7
		34–58	Light silty clay loam	CL or CH	A–6 or A–7
		58–70	Silt loam or silt	ML or CL	A–6 or A–7
Reesville: ReA, ReB2	2 to 4.	0–8	Silt loam	ML	A–4
		8–21	Silty clay loam	CL	A–6
		21–30	Light silty clay loam	CL	A–6
		30–60	Silt loam and silt	ML or CL	A–4
Rensselaer: Rm	1 to 2.	0–15	Loam	ML or CL	A–4 or A–6
		15–50	Clay loam	CL	A–6 or A–7
		50–66	Stratified sandy clay loam, silt loam, and loam.	CL	A–4 or A–6
Riverwash: Rr. Properties were not estimated.					
Rock land: Rs. Properties were not estimated.					
Ross:[2] Rt	More than 5.	0–17	Silt loam	ML	A–4
		17–40	Silt loam	ML	A–4
		40–50	Stratified silt loam, loam, and sandy loam.	ML	A–4
Shadeland: Sh	1 to 2.	0–6	Loam	SM	A–4
		6–13	Silt loam to light silty clay loam.	ML or CL	A–4 or A–6
		13–29	Silty clay loam	CL	A–6 or A–7
		29	Sandstone and shale bedrock.		
Stendal:[1] Sn	1 to 2.	0–10	Silt loam	ML	A–4
		10–55	Silt loam	ML	A–4
		55	Silt loam, loam, and coarse sand with some gravel.	ML	A–4
Strip mines: St. Properties were not estimated.					
Vigo: VgA, VgB2	1 to 3.	0–23	Silt loam	CL	A–4
		23–47	Silty clay loam	CL	A–7 or A–6
		47–60	Silt loam to silty clay loam	CL	A–6 or A–7
		60–80	Clay loam to loam	CL	A–6
Wakeland:[1] Wa	1 to 2.	0–55	Silt loam and silt	ML	A–4
Warsaw: WrA, WrB, WrC2, WsA	More than 10.	0–14	Loam	ML	A–4
		14–36	Gravelly sandy clay loam.	CL	A–6
		36–50	Stratified gravel and sand	SM	A–2
Westland:[3] Wt, Wv	Less than 2.	0–7	Silty clay loam	CL	A–6
		7–26	Silty clay loam	CL	A–6 or A–7
		26–44	Gravelly clay loam	CL	A–6 or A–7
		44–52	Sandy clay loam	SC or SM	A–4
		52–65	Stratified gravel and sand	SP–SM	A–1
Wilbur:[2] Ww	More than 5.	0–50	Silt loam or silt	ML	A–4
Zipp:[1] Zc	Less than 1.	0–31	Silty clay to clay	CH	A–7
		31–70	Clay	CH	A–7

engineering properties—Continued

Percentage passing sieve—			Permeability	Available moisture capacity	Reaction	Frost-heave potential	Shrink-swell potential
No. 10	No. 40	No. 200					
			In. per hr.	*In. per in. of soil*	*pH*		
100	90–100	90–100	0. 8–2. 5	. 23	6. 0–6. 5	Moderate to high	Low to moderate.
95–100	95–100	85–95	0. 05–0. 2	. 18	6. 5–7. 3	Moderate to high	Moderate.
95–100	95–100	85–95	0. 05–0. 2	. 19	6. 8–7. 4	Moderate to high	Moderate.
95–100	90–100	90–100	0. 2–0. 8	. 20	7. 4–7. 8	Moderate to high	Moderate.
100	95–100	75–85	0. 2–0. 8	. 20	6. 5–7. 3	Moderate to high	Low to moderate.
95–100	95–100	80–90	0. 05–0. 2	. 18	5. 1–5. 5	Moderate	Moderate.
95–100	95–100	85–95	0. 8–2. 5	. 19	6. 0–6. 5	Moderate to high	Moderate.
							Low to moderate.

TABLE 6.—*Interpretations*

of engineering properties

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road subgrade material	Highway location
Fox: FsA, FsB, FxA	Sandy loam (FsA, FsB) fair: low available moisture capacity. Loam (FxA) good.	Good: strata of sand and gravel at a depth of 24 to 42 inches.	Good	Soil features favorable.
Genesee: Gs	Fair: low available moisture capacity.	Fair: some stratified sand and gravel in places.	Fair: moderate frost heave.	Occasional overflow.
Genesee, sandy variant: Gn	Good	Not suitable	Fair: moderate frost heave.	Occasional overflow.
Gullied land: Gu. No interpretations made for purposes listed.				
Henshaw: HeA, HeB2	Good	Not suitable	Fair: moderate to high shrink-swell potential; moderate to high frost heave.	Seasonal high water table; moderate to high frost heave.
Hickory: HkE, HkF, HkF3, HkG.	Fair to poor: thin; low organic-matter content.	Not suitable	Fair: fair to poor compaction.	Unstable slopes; cuts and fills needed.
Iona: IoA, IoB2, IoB3	Good	Not suitable	Fair: moderate to high shrink-swell potential; moderate to high frost heave.	Moderately well drained; moderate to high frost heave.
Iva: IvA, IvB2	Good	Not suitable	Poor: moderate to high shrink-swell potential; moderate to high frost heave.	Seasonal high water table; moderate frost heave.
Kings: Kg	Poor: clayey	Not suitable	Poor: high shrink-swell potential; fair to poor compaction.	Seasonal high water table; flooding; high frost heave.
Lyles: Ly	Good	Not suitable	Good	Seasonal high water table; flooding.
Markland: MaB2, MaD2, MaE2, McD3.	Poor: thin; low organic-matter content.	Not suitable	Poor: high shrink-swell potential; fair to poor compaction.	Plastic soil material; cuts and fills needed.
McGary: Mg	Fair: thin	Not suitable	Poor: high shrink-swell potential; fair to poor compaction.	Seasonal high water table; plastic soil material.
Mine dumps: Mn. No interpretations made for purposes listed.				
Muren: MuB2	Good	Not suitable	Fair: moderate to high shrink-swell potential; moderate to high frost heave.	Moderately good drainage; moderate to high frost heave.
Parke: PaC3, PaD3	Good	Not suitable	Subsoil: moderate to high shrink-swell potential. Substratum: good.	Cuts and fills needed; side slopes subject to erosion.

[redacted]

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road subgrade material	Highway location
Patton: Pc	Poor: silty clay loam texture.	Not suitable	Poor: moderate to high shrink-swell potential; fair to poor compaction.	Seasonal high water table; ponding; moderate to high frost heave.
Petrolia: Po	Poor: silty clay loam texture.	Not suitable	Poor: moderate to high shrink-swell potential; fair to poor compaction.	Flooding
Princeton: PrA, PrB2, PrC2, PrD2, PrE2, PrG.	Fair: low available moisture capacity.	Poor: minor amounts of stratified sand.	Good	Soil features favorable
Ragsdale: Ra	Good	Not suitable	Poor: moderate shrink-swell potential; moderate to high frost heave.	Seasonal high water table; moderate to high frost heave.
Reesville: ReA, ReB2	Good	Not suitable	Poor: moderate shrink-swell potential; moderate to high frost heave.	Seasonal high water table; moderate to high frost heave.
Rensselaer: Rm	Good	Not suitable	Fair: moderate to high shrink-swell potential.	Seasonal high water table; flooding; moderate frost heave.
Riverwash: Rr. No interpretations made for purposes listed.				
Rock land: Rs. No interpretations made for purposes listed.				
Ross: Rt	Good	Not suitable	Fair: low to moderate shrink-swell potential.	Occasional flooding
Shadeland: Sh	Poor: thin; low organic-matter content.	Not suitable	Poor: moderate to high shrink-swell potential; bedrock at depth of 20 to 34 inches.	Seasonal high water table; moderate to high frost heave; bedrock at depth of 20 to 34 inches.
Stendal: Sn	Good	Not suitable	Fair: high frost heave	Seasonal high water table; flooding.
Strip mines: St. No interpretations made for purposes listed.				
Vigo: VgA, VgB2	Fair: low organic-matter content.	Not suitable	Poor: moderate to high shrink-swell potential; moderate frost heave.	Seasonal high water table; moderate frost heave.
Wakeland: Wa	Good	Not suitable	Fair: low to moderate shrink-swell potential; moderate to high frost heave.	Seasonal high water table; flooding.
Warsaw: WrA, WrB, WrC2, WsA.	Sandy loam (WrA, WrB, WrC2) fair: low available moisture capacity. Loam (WsA) good.	Good: interbedded sand and gravel below a depth of 24 to 42 inches.	Good	Soil features favorable

engineering properties—Continued

Soil features affecting—Continued					Soil limitations for sewage disposal fields
Farm ponds		Agricultural drainage	Terraces and diversions	Grassed waterways	
Reservoir areas	Embankments, dikes, and levees				
Seasonal high water table; slow seepage.	Fair to poor stability and compaction.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; slow permeability.
Flooding; seepage	Fair to poor stability and compaction.	Flooding; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; flooding; slow permeability.
Rapid seepage	Moderate to high permeability when compacted; fair to poor resistance to piping.	Good drainage	Severe hazard of erosion on slopes when not stabilized.	Hazard of erosion during construction.	Slight where slope is 0 to 6 percent. Moderate where slope is 6 to 12 percent. Severe where slope is more than 12 percent.
Seasonal high water table; slow seepage.	Fair to poor stability and compaction; good resistance to piping.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; slow permeability.
Seasonal high water table; slow seepage.	Fair to poor stability and compaction; fair resistance to piping.	Seasonal high water table; slow permeability.	Soil features favorable.	Soil features favorable.	Severe: seasonal high water table; slow permeability.
Seasonal high water table; seepage.	Low permeability when compacted; good resistance to piping.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; flooding; slow permeability.
Seepage	Low to moderate permeability when compacted; fair resistance to piping.	Good drainage	Not needed: nearly level.	Not needed: nearly level.	Severe: occasional overflow.
Shallow to bedrock.	Good resistance to piping: bedrock at depth of 20 to 34 inches.	Seasonal high water table; slow permeability; bedrock at depth of 20 to 34 inches.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; bedrock at depth of 20 to 34 inches.
Seasonal high water table; seepage.	Poor stability and compaction; poor resistance to piping.	Seasonal high water table; flooding.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; frequent overflow.
Seasonal high water table; slow seepage.	Slow permeability when compacted; good resistance to piping.	Seasonal high water table; very slow permeability.	Very slowly permeable claypan.	Very slowly permeable claypan; difficult to establish vegetation.	Very severe: very slowly permeable claypan.
Seasonal high water table; seepage; flooding.	Poor stability and compaction; poor resistance to piping.	Seasonal high water table; flooding.	Not needed: nearly level.	Not needed: nearly level.	Severe: flooding.
Rapid seepage	Subsoil: good resistance to piping; low permeability when compacted. Substratum: high permeability when compacted; fair resistance to piping.	Good drainage	Irregular slopes	Irregular slopes	Slight where slope is 0 to 6 percent. Moderate where slope is 6 to 12 percent. Hazard of pollution.

TABLE 6.—*Interpretations of*

Soil series and map symbols	Suitability as source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road subgrade material	Highway location
Westland: Wt, Wv	Poor: silty clay loam texture.	Poor: sand and gravel at depths below 5 feet.	Subsoil fair: moderate to high shrink-swell potential. Substratum good.	Seasonal high water table; ponding.
Wilbur: Ww	Good	Not suitable	Fair: moderate to low shrink-swell potential; moderate to high frost heave.	Seasonal high water table; flooding.
Zipp: Zc	Poor: clayey	Not suitable	Poor: high shrink-swell potential; fair to poor compaction.	Seasonal high water table; flooding and ponding; high frost heave.

Engineering classification systems

Two systems of classifying soils for engineering purposes are used in this soil survey. Most highway engineers classify soils in accordance with the system approved by the American Association of State Highway Officials (AASHO) (*1*). In this system soils are placed in seven principal groups, based on mechanical analysis and plasticity test data. The groups range from A-1, which consists of gravelly soils of high bearing capacity, the best soils for subgrades, to A-7, which consists of clayey soils that have low strength when wet, the poorest soils for subgrades. Highly organic soils, such as peat and muck, are not included in this classification, because they are not suitable for use as construction material or foundation material. The relative engineering values of soils within each group are indicated by group index numbers. The numbers range from 0 for the best material to 20 for the poorest. In table 4 the group index number is shown in parentheses following the soil group symbol, for example, A-4 (8). Group index numbers can be established only by laboratory tests. Estimated AASHO classifications for all the soils of the county are given in table 5.

Some engineers prefer the Unified soil classification system (*12*), which was developed by the Waterways Experiment Station, Corps of Engineers. This system is based on the identification of soils according to their texture and plasticity and their performance as engineering construction materials. In the Unified system, soils are identified as coarse grained (eight classes), fine grained (six classes), or highly organic (one class). Table 4 shows the Unified classifications of the soils tested, and table 5 shows estimated Unified classifications of all the soils in the county.

Engineering test data

Table 4 presents test data on samples of four soil series taken from twelve locations in the county. These samples were tested by standard procedures in the laboratories of the Joint Highway Research Project at Purdue University, under sponsorship of the Bureau of Public Roads. The samples do not represent all the soils in Sullivan County, nor do they include the entire range of characteristics of any series sampled. Not all layers of each profile were sampled. The test results, however, have been used as a general guide in estimating the engineering properties of the soils of the county. Tests were made for moisture-density relationships, liquid limit, and plastic limit. Texture was determined by mechanical analysis.

Moisture-density relationships indicate the moisture content at which soil material can be compacted to maximum dry density. If a soil is compacted at successively higher moisture content, assuming that the compactive effort remains the same, the density of the compacted material increases until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The ovendry weight, in pounds per cubic foot, of soil material that was compacted at optimum moisture content is termed the maximum dry density. Data on the relationship of moisture to density is important in planning earthwork, for generally a soil is most stable if compacted to about its maximum dry density when it is at approximately the optimum moisture content.

The California bearing ratio test measures the load-bearing capacity of soil material.

The tests for liquid limit and plastic limit indicate the effect of water on the consistence of soil material. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Mechanical analysis to determine the particle-size distribution of the soil material was made by a combination of the sieve and hydrometer methods. The names of the various particle sizes—sand, silt, and clay—do not mean

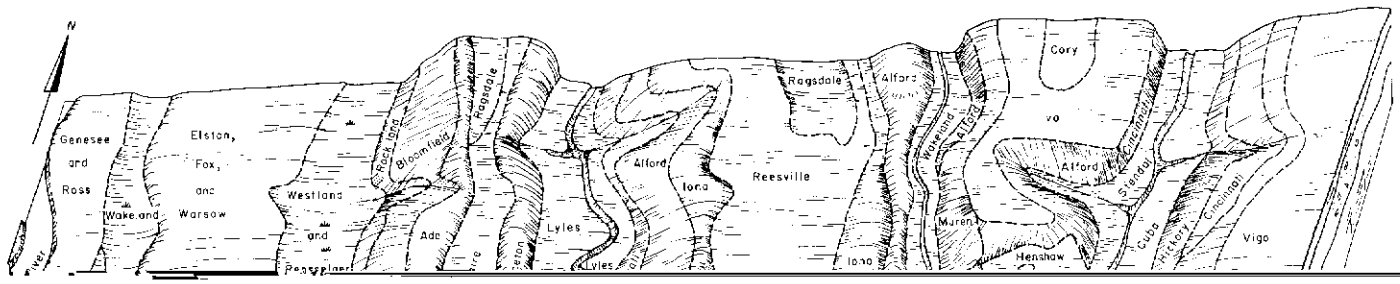
engineering properties—Continued

Soil features affecting—Continued					Soil limitations for sewage disposal fields
Farm ponds		Agricultural drainage	Terraces and diversions	Grassed waterways	
Reservoir areas	Embankments, dikes, and levees				
Seasonal high water table; seepage.	Moderate to slow permeability when compacted; fair resistance to piping.	Seasonal high water table; slow permeability.	Not needed: nearly level.	Not needed: nearly level.	Severe: seasonal high water table; slow permeability.
[illegible]	[illegible]	Seasonal high	Not needed:	Not needed:	Severe: seasonal

sentative profile of each soil series, as described in the section "Descriptions of the Soils."

Some soil features may be helpful in one kind of engineering work and a hindrance in another kind. For example, a permeable substratum would make a soil unhas accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are the active factors of soil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Elston, Fox, and Warsaw
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Bloomfield
Ade
Lyles
Alford
Reesville
Ragsdale
Alford
Cory
Alford
Cuba
Vigo
Henshaw

Relief

Relief influences soil formation by its controlling effect upon runoff and drainage.

The relief in Sullivan County ranges from nearly level to very steep. Most of the county has been dissected by weathering and stream cutting. The lowest point is 420 feet above sea level. It is in section 2, T. 5 N., R. 10 W., where the old channel of Busseron Creek crosses over into Knox County. The highest point is 640 feet above sea level. It is in the southwest quarter of the southwest quarter of section 3, T. 6 N., R. 8 W. The large flats west of Shelburn are at an elevation of 540 feet.

Differences in relief affect moisture and air conditions within the soils. Steep soils are not so well developed as level or sloping soils, even though the parent material was of the same type. The weaker development results

glacial period. Soils developed in this material are not so deeply leached nor so thoroughly leached as the soils that formed in Illinoian drift, and they have an immature profile.

Processes of Soil Formation

Most of the soils of Sullivan County have moderate to distinct horizons. A few have faint horizons. The differentiation of horizons is the result of one or more of the soil-forming processes. These processes are the accumulation of organic matter, the leaching of carbonates and salts more soluble than calcium carbonates, the translocation of silicate clay minerals, and the reduction and transfer of iron.

Some organic matter has accumulated in the surface layer of all the soils in this county. The organic-matter

about them, see their relationships to each other and to the whole environment, and develop principles that will help us to understand their behavior and response to use. First through classification and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Two systems of classifying soils above the series level the development of the system should refer to the latest literature available (*6*).

The current system consists of six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are measurable or observable, but the proper-

Sullivan County according to both the current system and the great soil group of the 1938 system. The categories of the current system are defined briefly in the following paragraphs.

ORDER.—Soils are grouped into orders according to properties that seem to have resulted from the same processes acting to about the same degree on the parent material. Ten soil orders are recognized in the current system: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates. Five of the ten soil orders occur in Sullivan County: Inceptisols, Mollisols, Alfisols, Ultisols, and Histosols.

Inceptisols occur mostly on young, but not recent,

Additional Facts About the County

This section gives general facts about Sullivan County. It briefly discusses farming and natural resources, climate, water supply, and drainage. It also discusses industries, transportation, and markets.

Farming and Natural Resources

The 1964 Census of Agriculture shows 70.8 percent of the land in Sullivan County, or 207,041 acres, was in farms. The number of farms was 1,053, and the average size was 196.6 acres. Of these farms, 602 were run by full owners, 355 by part owners, and 96 by tenants.

Grain farming and the raising of livestock, chiefly hogs and cattle, are the major enterprises in Sullivan County. The soils in the western and central parts of the county are

TABLE 8.—*Temperature and precipitation data*

[Data from Farmersburg. Most statistics cover a period of 51 years]

Month	Temperature			Precipitation					Mean number of days with—			
							Snow or sleet		Maximum temperature of—		Minimum temperature of—	
	Mean daily minimum	Monthly mean	Mean daily maximum	One year in 10 will have less than—	Mean	One year in 10 will have more than—	Mean	Maximum monthly	90° F. or above	32° F. or below	32° F. or below	0° F. or below
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*	*Inches*	*Days*	*Days*	*Days*	*Days*
January	22	31	39	0.7	2.7	7.3	4.0	16	0	7	25	2
February	24	33	41	.5	1.9	3.6	3.4	19	0	5	22	2
March	33	43	53	1.4	3.4	7.0	2.7	22	0	2	16	(2)
April	42	53	64	1.7	3.3	6.3	.2	2	0	(2)	5	0
May	53	64	74	1.3	4.6	8.9	(1)	(1)	(2)	0	(2)	0
June	61	72	82	1.6	4.0	7.5	0	0	6	0	0	0
July	65	77	88	1.0	2.9	5.6	0	0	13	0	0	0
August	63	75	86	1.0	3.4	6.4	0	0	9	0	0	0
September	57	69	80	1.0	3.7	6.3	0	0	4	0	(2)	0
October	45	57	68	.7	2.9	5.7	.1	1	(2)	(2)	3	0
November	34	44	53	1.1	2.6	4.6	.6	6	0	1	13	(2)
December	25	33	41	.7	2.4	4.7	3.4	12	0	7	23	(2)
Year	44	54	64	28.7	37.8	46.3	14.4	[3] 40	32	22	107	4

[1] Trace. [2] Less than half a day. [3] Greatest annual amount during period of record.

of low rainfall occurs in summer, when crops need a lot of water and evaporation is rapid because of wind and high temperatures.

Table 8 gives indications of low and high monthly amounts of rainfall. In July, for example, rainfall is less than 1.0 inch in 1 year out of 10 and more than 5.6 inches in 1 year out of 10. The probability of too much rain in spring is high. Heavy rain early in spring can cause flooding along the Wabash River, and such rains a little later in spring can delay planting of crops. If planting is delayed and the crop season has a late start, an early frost in fall is detrimental. Tender crops are sometimes killed by an unusually late spring freeze. Ordinarily, the number of days between the last spring freeze and the first fall freeze is sufficient for the common crops to mature.

In 51 years the temperatures at Farmersburg, in the northern part of Sullivan County, ranged from −24° to 111° F. In a typical year the temperature ranges from about 0° to 96°. Adapted crops are not damaged by the high temperatures of summer if moisture is adequate, but high temperatures accelerate evaporation and remove moisture rapidly.

The cold temperatures of winter cause some problems in overwintering crops. In some winters the freezing or thawing of soils can heave or lift some of the young plants of a small-grain or forage crop. A snow cover protects crops from the cold and from alternate freezing and thawing. Snowfall averages a little more than 14 inches a winter season but is extremely variable.

Extremely low temperatures kill fruit trees. Orchardists need to select sites for orchards with care, avoiding cold-air pockets and choosing south-facing slopes, in order to get the maximum benefit from solar radiation.

The wind is from the southwest most of the time, but in some winters the prevailing wind is from the west or northwest. Damaging winds seldom occur. Tornadoes are so small and infrequent that property loss and casualties resulting from them are less than those resulting from lightning. Only five tornadoes have been reported in a 44-year period.

Relative humidity commonly is nearly 100 percent at the time of the day when the temperature is lowest, usually just before sunrise. If it remains near 100 percent for a period of time during the night, heavy dew or frost accumulates. If other factors are normal, relative humidity declines as the temperature rises. A relative humidity of 40 to 50 percent is common on summer afternoons. In winter the relative humidity is 10 to 20 percent higher.

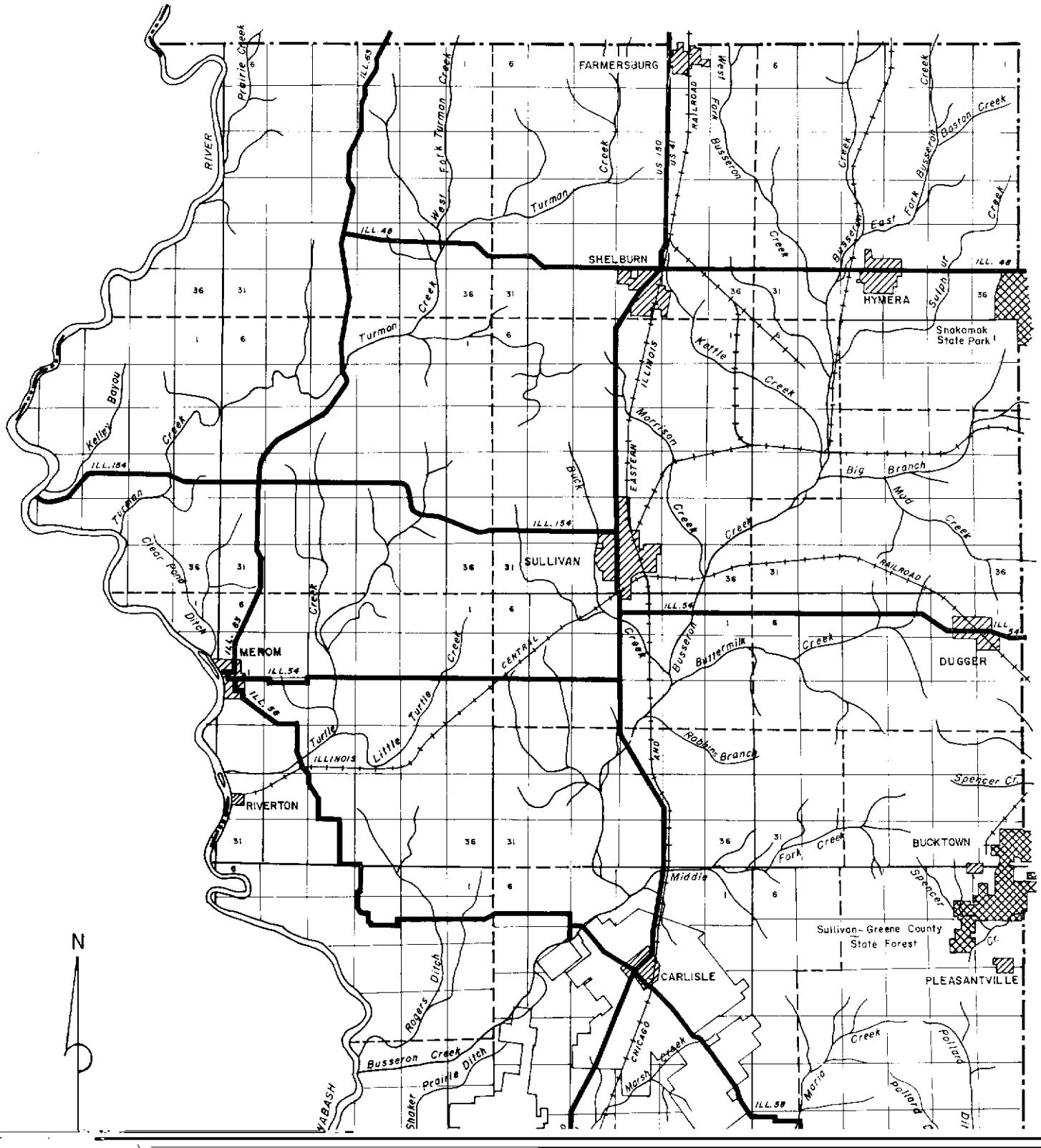
Fog at night and early in the morning is associated with 100 percent relative humidity, a calm wind, and cold-air pooling. Such fog is most prevalent in the lowlands along the Wabash River.

Water Supply

Drilled wells are the principal type of water wells in this county. A small number of driven wells and dug wells are still in use, and occasionally a new one is constructed (*13*).

In upland areas sandstone is the principal source of ground water. It has been tapped for many domestic wells and stock wells and for a few small industrial wells. These wells are 40 to 500 feet deep but are most commonly about 100 feet deep. They produce from 0.1 gallon to more than 50 gallons per minute. Some dry holes are reported.

Farther to the north, on broad terraces and bottom lands along the Wabash River, are large deposits of


FARMERSBURG
SHELBURN
HYMERA
Shakamak State Park
SULLIVAN
MEROM
RIVERTON
DUGGER
BUCKTOWN
CARLISLE
PLEASANTVILLE
Sullivan-Greene County State Forest
ILL. 48
ILL. 154
ILL. 54
ILL. 58
ILL. 63
US 41
US 150
RAILROAD
ILLINOIS
CENTRAL
EASTERN
CHICAGO
Prairie Creek
West Fork Turman Creek
Turman Creek
West Fork Busseron Creek
Busseron Creek
East Fork Busseron Creek
Sulphur Creek
Kelley Bayou Creek
Clear Pond Ditch
Kettle Creek
Morrison Creek
Buck Creek
Big Branch
Mud Creek
Buttermilk Creek
Robbins Branch
Spencer Ck.
Middle Fork Creek
Little Turtle Creek
Rogers Ditch
Shaker Prairie Ditch
Marsh Creek
Pollard Ditch
WABASH
N

glaciofluvial sand and gravel. These deposits are an important source of ground water for domestic, stock, and industrial needs and for irrigation. They also supply the water for most of the towns and cities in the county. The town of Dugger obtains its water from similar deposits along the White River in Greene County. Wells in these deposits are 45 to 75 feet deep but are most commonly about 55 feet deep. They produce from 3 to more than 1,000 gallons per minute.

Lacustrine deposits and glacial till along Busseron, Turman, and Turtle Creeks are not used extensively as a source of ground water, but they are potential sources for small domestic and livestock supplies. These deposits overlie bedrock or are interbedded with or overlie glaciofluvial sand and gravel. Wells in these deposits are 40 to 120 feet deep and produce from 0.5 to 30 gallons per minute.

The quality of water from drilled wells varies greatly. In most of the county the content of iron and, locally, the content of either chloride or sulfate exceed the 1946 U.S. Public Health Service standards for drinking water.

In areas where the yield from ground-water sources is low, or where the content of chloride or sulfate is excessive, the water supply must come from lakes and ponds. During the past few years a large number of farm ponds have been constructed. These ponds supply water for stock, for fire protection, and for wildlife habitat.

Drainage

Almost all of Sullivan County is drained by the Wabash River and its many tributaries (fig. 12). The Wabash is the western boundary of the county.

for homes and other structures. Coal mining is still an important industry in the eastern part of the county. There are a number of producing oil wells, and other extensive operations are in progress to recover oil from older workings west of the city of Sullivan. A cheese factory and two factories that manufacture garments for women are located in the city of Sullivan. A small packaging company is located in Shelburn. A large electrical power plant has been built on the Wabash River west of Fairbanks.

Two railroads run through the county. Federal Highway 41 and a smaller paved road, Route 63, in the western part of the county, serve the north-south traffic. Routes 48, 154, 54, and 58 are east-west paved roads. A bridge on Route 154 crosses the Wabash River into Hutsonville, Illinois. A small ferry at Merom is the only other river crossing in the county. Bus transportation is available in most small towns. A small airport for noncommercial planes and several private landing fields are located north of Sullivan.

A sale barn in Linton, Indiana, provides a market for feeder pigs and calves. Other markets for livestock are in Vincennes, Terre Haute, and Indianapolis, Indiana.

Grain elevators are not adequate for all the wheat and soybeans at harvest time. Freight cars are used to supplement the elevators.

Literature Cited

(1) AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. 1961. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 v., 401 and 617 pp., illus.

(2) BALDWIN, M., KELLOGG, C. E., and THORP, J., 1938. SOIL CLASSIFICATION. U.S. Dept. Agr. Yearbook 1938:

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Catena. A sequence, or "chain," of soils on a landscape, developed from one kind of parent material but having different characteristics because of differences in relief and drainage.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of the following: soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

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